ECOLOGICAL CALENDARS FOR CLIMATE CHANGE ADAPTATION IN SARY MOGOL, KYRGYZSTAN

A Thesis

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by

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ABSTRACT

Ecological calendars have been used by communities in various contexts for timing agricultural and cultural events as well as for grounding them in place. While these calendars are fluid and adaptable by nature, outside forces have caused many of them to be diminished in their usability. In Sary Mogol, a community located in the Pamir-Alai Mountain Range in Kyrgyzstan, these forces have taken the form of Soviet era restructuring and collectivization, resulting in discontinuity of knowledge transfer. Climate change is an additional pressure on this community which relies heavily on pastoralism and crop production. This thesis takes a holistic approach in addressing the question of if the revitalization of ecological calendars can assist communities facing the pressures of climate change, through the synthesis of an ecological calendar of Sary Mogol and an analysis of the influence of the nearby coal mine and other pressures.

BIOGRAPHICAL SKETCH

Kayla grew up in Midcoast Maine and has a background in the field of ecology. She earned a BA in Natural History from Sterling College in Vermont in 2013. While at Sterling, she completed a three-month internship in Mongolia as a field technician on a graduate student's project of cooperative breeding in Azure-winged Magpies. During this time she also researched local knowledge of medicinal plants for her undergraduate thesis and developed an interest in indigenous and local knowledge. For three years, she held several different temporary positions: in Prudhoe Bay, Alaska on a long-term shorebird nest monitoring project for the Wildlife Conservation Society; at Hawk Mountain Sanctuary in Pennsylvania as an environmental education intern; in Mindo, Ecuador at Reserva Las Tangaras as a co-manager; in Wyoming as a wetland botany field technician for the University of Wyoming; as a backcountry ski guide in Yellowstone National Park; and in Utkiagvik, Alaska on a waterfowl migration project with the Wildlife Conservation Society. During many of these positions she also worked with different indigenous or local groups. She has also spent several years working as a dairy hand and as a carpenter's assistant. These experiences have informed her work by providing an understanding of and appreciation for community systems and the reality of working with and on the land. Her immediate plans include working as an Island Supervisor for the Audubon Society in Maine during the summer of 2018 and traversing the Americas with her Suzuki DR650s.

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CONTENTS

INTRODUCTION

"And when you crush an apple with your teeth, say to it in your heart, 'Your seeds shall live in my body, and the buds of your tomorrow shall blossom in my heart, and your fragrance shall be my breath, and together we shall rejoice through all the seasons.'"– Kahlil Gibran

Context within the ECCAP Project

This thesis will primarily address the identification of reliable seasonal indicators within the ecological calendar of Sary Mogol for climate change adaptation and will also make recommendations for future investigation based on these indicators. I synthesize these indicators into a written ecological calendar of Sary Mogol and identify critical indicators which deserve further research. However, this project cannot stand alone. It is preliminary to concrete work on climate change adaptation in the Pamir Mountains.

This research was done as part of Ecological Calendars and Climate Adaptation in the Pamirs (ECCAP), a project headed by Dr. Karim-Aly Kassam of Cornell University, and in collaboration with Dr. Antonio Trabucco of the Euro-Mediterranean Center on Climate Change, Dr. Jianchu Xu of the Kunming Institute of Botany at the Chinese Academy of Sciences, and Dr. Cyrus Samimi of the University of Bayreuth. Three sites are being incorporated into the project: the communities of Savnob and Roshorv in the Bartang Valley, Gorno-Badakhshan Autonomous Oblast, Tajikistan, and Sary Mogol, in the Alai Valley, Osh Province, Kyrgyzstan. I assisted in field work at the first two sites, but my colleague Talia Chorover was the primary researcher there, while I usually conducted interviews at Sary Mogol, and was responsible for analyzing these data. The sites were selected by the PI's, based on their previous experiences working in

the region. The PI's had already made connections with community members to gauge interest in such a project prior to conducting interviews, especially through the workshop in Sary Mogol.

The goal of the ECCAP project is "to build anticipatory capacity for climate change among mountain communities through the revitalization of ecological calendars" (Kassam et al, 2015). As described by Kassam et al in "Anticipating Climatic Variability: The Potential of Ecological Calendars" (2018), climate change is affecting indigenous and mountain communities disproportionately to how much they have contributed to the phenomenon. Additionally, climate change is inhibiting food security and causing anxiety in mountain regions through unpredictability. Kassam et al (2018) recognize the potential within ecological calendars and indigenous knowledge for climate change adaptation for communities. Through the case study in the Pamir Mountains, Kassam et al use transdisciplinary collaboration, the generation of a seasonal round, the identification of reliable seasonal indicators, and the cogeneration of knowledge as the starting point for reviving ecological calendars. Furthermore, they list the following expected outcomes:

> "Transfer of knowledge between communities in different bioclimatic zones through workshops so that shared insights inform praxis; hosting an international conference focusing on ecological calendars to improve food security and resilience; and development of school curricula for inter-generational transfer of knowledge and continued adaptation of calendars" (p. 7).

Research Questions

I ask the following questions:

1) What are the critical components of an ecological calendar in Sary Mogol?
2) What role can an ecological calendar have in climate change adaptation in Sary Mogol?

Study Site

July 18, 2017: Interviewed three folks at jaillo (summer pasture) today. Welcoming people, bread and soup with organs. I'm in the herder's home right now. We just interviewed three people and ate a full lunch. The housewife is praying on a blue and green handwoven mat. Daler and I just went looking for plants: wild onion, Sanguisorba sp., mints, forget-me-nots, edelweiss.

[It is imperative for me to describe the field season by providing some description of what I was seeing and experiencing in that place. I will do this through occasional excerpts of my field journal, which through setting the scene, will give insight not just on the place, but on how I operated within it.]

Sary Mogol is located in the Alai Valley of the Pamir Mountains of Kyrgyzstan (see map in Appendix). This region is bordered by Tajikistan to the south and by China to the west. The town is within the Alai District, part of Oshskaya *oblast*, or province, an arm at the southwestern-most area of Kyrgyzstan (Sonntag, 2016). Sary Mogol is arid and montane, at 3,068 meters in elevation. About ten percent of the area's flora are endemic, while cropland only constitutes about one percent of the region (Agakhanyantz & Lopatin, 1978), (Förster et al, 2011). Due to being situated in the wide Alai Valley and near (approximately three hours by car) the region's capital, Osh, Sary Mogol has relative access to metropolitan areas and goods and

services, especially in contrast to other sites we have worked at in the Pamir-Alai region. Wi-fi internet, imported fruits, ice cream, reliable cellular service, and opportunities for capitalizing on tourism are all accessible to residents. Sary Mogol is a place where many contrasting forces collide. It is transected by a road that leads to an intersection, taking one to nearby Tajikistan or China. Most residents or their parents were born either in the Chong-Alai Valley, or in places such as Kara Kul and Murghob in the Gorno-Badakhshan Autonomous Region in the nearby Pamir Mountains of Tajikistan. It was not until collectivization that the Kyrgyz began to grow crops: previously, they were nomadic and relied on animal husbandry, and to some extent, hunting and foraging. Now most families grow barley, potatoes, and animal fodder (a semi-wild member of Fabaceae called *spotsef* is used, as well as other varieties), and some plant carrots, onions, garlic, radishes, and greens. A few homes, especially those near the river, are shaded by domestic willow trees. No other trees grow in Sary Mogol, although elsewhere in the Pamirs trees and shrubs such as buckthorn *(Hippophae spp.)* and poplar *(Populus spp.)* can be found.

Kyrgyz, a Turkic language in the Altaic group, is the native language (Kreutzmann, 2003). It is currently written in Cyrillic, although there has been some debate over the possibility of romanization (Landau, 2010). About 50,000 Kyrgyz people live in Tajikistan, Xinjiang, Afghanistan, and Pakistan, while about 3,000,000 Kyrgyz inhabit Kyrgyzstan, other parts of China, and other Turkic-speaking Central Asian Republics (Kreutzmann, 2003). The Kyrgyz primarily practice Sunni Islam, along with most ethnic Tajiks, unlike other groups such as the Wakhi.

The Kyrgyz are a historically marginalized people. They have moved across the Central Asian steppe as the result of various events, including the Russian colonial expansion, the Bolshevik revolution, the Chinese Communist revolution, and the Soviet expansion, finally

coming to land in the Pamir Mountains (Callahan, 2007). The Kyrgyz people have practiced pastoralism for thousands of years, relying on the practice of transhumance, local migrations with animals to productive grazing land (Kerven et al, 2012). For the Kyrgyz, transhumance has usually occurred over an elevation gradient. However, Soviet demands forced the Kyrgyz into a restructured system of sedentary, collective farms, the effects of which have a lingering presence today in the lives of the people. These effects include degraded pastureland due to the overuse caused by sendentarization, emigration from rural areas, and loss of mobility (Ibid). This likely also resulted in a loss of traditional ecological knowledge, especially in the form of ecological calendars.

Nomads were forcibly settled on *kolkhoz* (*kollektivnoe chozjajstvo*: collective economy), or collective farms (Kreutzmann, 2009). After collectivization in 1978, Rahman Kul, the incumbent *khan,* escaped along with 1,132 other Kyrgyz to Eastern Anatolia by way of Pakistan. The descendants of these exiles now number 2,000, and practice sedentary agriculture and animal husbandry (Kreutzmann, 2009, p. 119). However, a group of Kyrgyz opted to return to the Afghan Little Pamir after leaving Pakistan rather than joining Rahman Kul. They fared not as well: today, borders limit their traditional trade routes and they are partially reliant on external humanitarian aid (Ibid).

After the collapse of the Soviet Union and a transition to privatization by the late 1990s, recession set in and lasted for six years, being one of the worst economic situations in any of the newly appointed Central Asian Republics (Steimann, 2011, p.63). This delayed recession may be due to the slow loss of Soviet infrastructure and its substitution with a privatized system. Land was briefly managed with the Land Redistribution Fund, but by this point, much of the arable land had already been redistributed at the community level (Ibid, p. 67). However, land

privatization resulted in a severe decrease in agricultural output because of fodder shortage, disease, mass slaughter, and lack of investment, fertilizer, and farm equipment (Ibid, p. 70). Today, the Kyrgyz have dealt with these challenges through reliance on a diversified agricultural system that includes short and long-distance migration, hired herders, grazing cooperatives, and alternative or supplemental income (Farrington, 2005).

Ecological calendars in Sary Mogol may continue to be at risk due to shifting demographics. Other studies of traditional ecological knowledge in communities experiencing social or cultural change demonstrate this (Zent, 2001) (Ohmagari & Berkes, 1997). The World Bank reports that 30% of Kyrgyzstan's GDP is accounted for by remittances, meaning that significant numbers of adults are leaving the country and breaking the transmission of traditional knowledge, as parents have been shown to be an important link in the transmission of traditional ecological knowledge (Lozada et al, 2006). Russia is a major destination for Kyrgyz and other Central Asian migrant workers (The Economist, 2016). However, within the past year, Russia's economy has been compromised by low oil prices and a poor exchange rate, resulting in many itinerants returning to their home country (Farrell, 2015). This could result in a weakened Kyrgyz economy and stressed resources, putting increasing pressure on the Kyrgyz people to ensure their own food and health security and making the role of traditional ecological knowledge and ecological calendars ever more important in communities.

Methods: Workshop

In July 2016, Dr. Karim-Aly Kassam, Dr. Cyrus Samimi, Dr. Antonio Trabucco, Tobias Kraudzun, Daler Kaziev, and Thomas went to Sary Mogol and conducted a workshop, the purpose of which was to identify community members to contribute to the creation of a seasonal

round during the workshop and to later participate in interviews. During the workshop, participants were provided with a meal, and answered questions related to ecological calendars and phenology, such as: *How do people in Sary Mogol know when the winter has ended?; How many seasons do you have?; When is barley harvested?* (see appendix). Participants were selected based on the amount of knowledge they were presumed to have surrounding ecological calendars, which was dependent on age and occupation as well as the recommendation of community partners. These community partners are members of a tourist agency which extends beyond having a mere business role and meets various needs of the community. While we eventually interviewed nearly equal numbers of men and women (twenty women and twenty-one men; the extra numbers are due to some joint interviews occurring), all of the 32 people invited to participate in the workshop were men. Kaziev attributes this to the strength of the *aksakal,* or "white beard" system of social structure. The average age was 64, and the mode was 73 (one age unknown). The youngest participant was 38, and the oldest, 80. Seven of the invitees did not attend (one unknown). Participant occupations were primarily pastoralists, hay transporters, and other "land users". Also invited were people who are highly involved in the community, such as teachers and doctors.

As written in the workshop notes, the workshop began with welcoming the participants and an explanation of the purpose of the research (see appendix). The workshop participants were then given the opportunity to ask questions about the project. Finally, Kassam provided a presentation with slides about ecological calendars and climate change that outlined the effects of climate change on other communities in the Pamirs and the world, the function of ecological calendars, work that the group had already done on ecological calendars elsewhere, and the objectives of the research in Sary Mogol. The four objectives are to: 1. Recreate an ecological

calendar that has practical applications in Sary Mogol; 2. Create curricula with the goal of passing along this knowledge of ecological calendars; 3. Build an online platform where this knowledge can be shared; 4. Host an international conference focusing on ecological calendars and climate change resilience. Again, participants were invited to ask questions, and then the creation of the seasonal round began. The seasonal round was drawn on a large sheet of paper by Kraudzun, while Kassam asked questions of the audience through a translator, Kaziev, an ethnic Kyrgyz from the Eastern Pamirs of Tajikistan who later worked with us during interviews. Notes were taken by Samimi, Trabucco, and Thomas Senftl. The seasonal round was based on these questions, beginning with, *How do people in Sary Mogol know when the winter has ended?* Questions addressed agricultural and social activities, celestial events, phenology of domestic and non-domestic organisms, cultural events, and weather events.

Methods: Semi-structured Interviews

Prior to entering the field, on March 8th, 2017 we applied for IRB approval, which was approved due to the nature of our interview questions. Over a period of fourteen days with the assistance of a translator, Daler Kaziev, myself and my fellow researcher, Talia Chorover, conducted thirty-nine semi-structured interviews in the month of July 2017. While our translator was not a resident of Sary Mogol, being from the Pamir Mountains of Tajikistan, he identified as Kyrgyz and had a common language and religion, and thus had what he termed clanship with many of our interviewees. We primarily used the convenience sampling method to find participants. We would walk along the main road transecting the length of Sary Mogol, and our translator would intercept people along the road, or call out to them if they were in their dooryards or gardens. We were often turned away, either because a potential participant had

work to do, or because they insisted that they did not have any knowledge relating to ecological calendars and did not want to participate. We also used the snowball sampling method by asking for recommendations from interview participants and contacting people who had participated in the previous year's workshop. Initially we sought out older, more experienced interviewees, such as pastoralists, hunters, and other people who rely primarily on the land for income or subsistence. After we had gained a strong foundation of information surrounding ecological calendars, we became more inclusive and interviewed younger people, and other people whose attachment to the land may not have been as strong, such as women who had non-agricultural jobs and did not have a primary role in agricultural activities at home. This was with the aim of gaining more information about the role of ecological calendars in the community, and how they may or may not be a valued component of livelihoods and culture in Sary Mogol.

Interviews typically began with being invited into a person's home, offered tea and bread, and providing an explanation of the project. Our translator would give interviewees the opportunity to end the interview at any point, to withhold their name, or to decline recording the interview or taking photos. After we had an understanding of the participant's boundaries, we asked them to consent to participate on a voice recorder, and the interview began. While we began with an interview guide that we developed before going to our sites (see appendix), our questions evolved based on the background of the interviewee and new knowledge that we obtained. A typical set of interview questions from Sary Mogol follows.

1. When and where were you born? Have you lived in Sary Mogol for your whole life?[1]
2. Do you use the Kyrgyz aye?

[1] The first and second questions were added to the list shortly after beginning interviews in Sary Mogol.

3. How would you describe the Kyrgyz aye?
4. When does the year begin for you?
5. How do you know that winter is over and spring is beginning?
6. What are some signs of spring?
7. When do the different livestock give birth?
8. When do the different wild animals give birth?
9. What crops do you grow?
10. How do you know it is time to plant these crops?
11. When did you plant barley and potatoes this year? When did you plant them last year?
12. How do you know it is time to take your animals to summer pasture?
13. What are some signs that spring is ending and summer is beginning?
14. What are some of your summer activities?
15. What are some signs that summer is ending and fall is beginning?
16. How do you know it is time to harvest each crop?
17. When did you harvest barley and potatoes this year? When did you harvest them last year?
18. What are some signs that fall is ending and winter is beginning?
19. What are some of your winter activities?
20. Do you use celestial events to time your activities?
21. Do you think that the signs you have told us about will continue to have value in the future?

Chorover would typically transcribe the interview, while I asked questions with Kaziev. The notetaker would interject if she wanted to clarify an answer, explore an idea, or had noticed

that a key question had been omitted. The interviewer also took notes during interviews, especially about body language and behavioral communication, to provide more insight during analysis. As most interviews (a few participants chose to not record the interview) were recorded, we had the opportunity to listen to the recording in order to check the transcription. After each interview, Chorover and I would review and edit the transcription, consulting Kaziev when we needed clarification.

A Fluid and Ever Adapting Method

While we entered the field with a list of interview questions, we adapted them to fit each interviewee. For example, as we completed more interviews, it became apparent that the nearby coal mine was an important issue, and we began to ask participants about their perception of the coal mine. If a participant was eager to talk about something not overtly related to ecological calendars and climate change, such as economics or the mine, we gave them the opportunity to discuss this. When one workshop participant showed us an ecological calendar that he had drawn and painted, we focused on this. When an elder voiced concern over health, economic, and women's issues, we listened to her and asked her about her work in the community. Occasionally a participant would mention a certain plant and would take us outside to see it.

When planning for field work in the US, we had decided to do interview-based mapping. With the gracious help of Dr. Stephen Morreale of Cornell, I printed out 2'x3' aerial images from Google Earth. The intent was to overlay the maps with a sheet of plastic, and allow interviewees to mark on this areas that they had mentioned during interviews. After they had marked and named each location, we would photograph the map and overlay, and erase the marks so that the plastic could be made into another map. When I created the maps, I had a very

poor understanding of land use in those particular communities, and while I incorporated the village and surrounding pastures into the map, I neglected to include distant pastures, hunting areas, and other communities that were important for trade. At the sites in Tajikistan, we had a 1:500,000 tourist map which we substituted. Because this method had worked well in Savnob and Roshorv, we anticipated repeating it in Sary Mogol. However, it quickly became apparent that mapping would not garner as much rich information in Sary Mogol as it did at the other sites. Residents of Sary Mogol infrequently mentioned other locations, such as specific pasture names or hunting locations. Also, the interview participants of Sary Mogol seemed to harvest fewer medicinal plants, perhaps because they had easier access to conventional medicine than those at the Tajik sites. The medicinal plants that most people in Sary Mogol mentioned could be harvested in their dooryards, in contrast to the pastures and alpine regions at the Tajik sites. My speculation is that this is because collectivization caused more of an uprooting from pastoralism for the current residents of Sary Mogol than it did for the people of the Bartang Valley. Residents of Sary Mogol were also more likely to at least partially rely on alternative sources of income and/or hire a herder to take their livestock to pasture. Arguably, because of the less direct connection to pastures, the people of Sary Mogol may have lost some of the knowledge of medicinal plants found at pasture, or at least the means or incentive to collect them.

Limitations

While Kaziev had prepared for the work with Kassam prior to doing interviews, there were still some limitations. Kaziev is trained as an anthropologist, not as a translator, so he had a tendency to ask his own questions, ask questions in a particular way, or to ask questions without him posing them to us first. While his insider perspective was helpful, it often led him to take

control of interviews, leaving the transcriber questioning what exactly Kaziev had asked interviewees, or preventing the interviewer from exploring different themes. As an "insider" Kaziev may also have taken some information for granted, while we were left wondering about some statement.

While translation was often clear enough, we soon realized that it was not word for word translation. This could mean key differences in meaning at times. For example, should the statement: "When the marmots come out we plant" be taken to mean: "We plant when we see the marmots emerge", or: "We plant as the marmots emerge"? A simple mistake in word choice could lead to very different interpretations. We sometimes did not catch these problems due to lack of foresight, or simply because the interview was moving at such a fast pace and needed to cover so much ground that we had little time to step back and review the data.

Due to the breadth and depth of the interview questions we were unable to spend adequate time examining every theme with interviewees, leaving many unanswered questions for future inquiry. As the interviews were semi-structured, individualized, and implemented with a qualitative analysis in mind, they did not provide the type of data that could be conducive to a quantitative analysis, which might elicit other results that we would have no way of producing otherwise.

With this type of data collection and analysis, saturation would have required us to interview every available individual in Sary Mogol, and even to return for follow-up interviews. While this is unrealistic, we had planned on spending more time in Sary Mogol and speaking with more people. However, Kaziev had to leave Sary Mogol for a conference so we needed to finish before then. I had initially planned on spending some time traveling around Kyrgyzstan,

and then returning to Sary Mogol to do follow-up interviews and to see the mine but was obliged to return to the US due to a family emergency.

While this work may have benefited from a statistical analysis, the interview protocol was designed with qualitative methods in consideration, rather than quantitative. After returning from the field I considered doing a principle components analysis to compare attitudes and uses of the ecological calendar in Sary Mogol, however, due to the relative inconsistency of the semi-structured interviews, it became apparent that this would not be possible.

Finally, while we gained many insights from participant observation in the Bartang Valley, we made fewer personal connections in Sary Mogol. This may be due to the fact that Sary Mogol is a much larger town, and tourism is popular there. It was natural for us to become integrated into the community in Roshorv and Savnob, but in Sary Mogol, there were a different structure and norms in place for interacting with foreigners.

Analysis

After returning from the field, I imported all 39 interviews into ATLAS.ti, a program for organizing qualitative data. I also transcribed my field notes and the workshop notes and imported these. All material was then coded with ATLAS.ti based on a coding system already designed by myself along with Dr. Kassam's research group during group meetings and adapted to this project.

The Calendar of the Human Body

Preliminary to addressing the research questions is an investigation of how time is measured in Sary Mogol. The calendar of the human body was initially recorded in Persian by

time keepers, or *hisobdon,* and later, by several Russian ethnographers, as well as by Kassam et al (2011). This calendar is endemic to the Pamir Mountain region and thus is a rich store of place-based knowledge, encompassing phenology, the human body and its experience within the environment, and the community. The calendar of the human body is divided into time that is tracked in association with parts of the human body, and *chilla*, which are interim periods. Generally, the calendar begins in the spring, which corresponds with the sun "being in" the feet and cycles up through the body to the higher parts such as the heart, chest, throat, or head. The temporal aspects of the calendar are usually grounded in physical associations with the body. For example, Kassam et al (2011) describe how "in the spring, the sun is in the intestines, a time of changing precipitation and avalanches, much like the churning in the stomach."

In the ECCAP proposal, Kassam et al (2016) mention that "calendars of the human body or similar ecological calendars have been used in other parts of the Pamir, including in Kyrgyzstan and China." Findings from our interviews in Sary Mogol support this. While interviewees did not refer to the human body in relation to counting time, they often mentioned 40 and 90-day periods of human inactivity called *childe*, which may be related to the *chilla* of the calendar of the human body. They also often spoke of the human body when referring to celestial and weather events. This could be interpreted as mere metaphor, however, it might be more closely related to a rejection of making one's community "the other." One interviewee said in reference to predicting the weather, "It is about when the moon gives birth, because every moon gives birth" (31). Another described the hottest days of summer as *saratan tudu*, or summer giving birth (20). A third person used several metaphors to describe phenological events, saying:

> "As soon as we feel/hear the first thunder [of the summer], we bang a bucket and do seven circles around the yurt and say: *jer jarylyp kok chyk, jelin arylyp syt jyk.* It means, *let the milk come from the overflowing udder, let the earth be cracked by the plants*. When a shift happens between summer and fall, you have this idea called *kunbala tashtade.* This means that there is a miscarriage of the sun, the summer is over too soon – people will be regretting things, it is too bad that there is no more summer. Prior to this, in the peak of summer, we say: *saratan tudu*, which means that summer gives birth. And then you start to anticipate whether or not there will be the miscarriage of the sun. This sun miscarriage happens when it is a short summer and there is an early arrival of fall" (32).

These examples may be better recognized as a real and integrative way of viewing one's environment than as "metaphor." As Kassam (2009) describes in *Biocultural Diversity* with an example from Arctic Alaskan communities, people have the potential to experience their environment without a nature-culture binary. My interactions with people in Sary Mogol suggest that this may be the case in this community as well. As described later in this thesis, people in Sary Mogol trust the knowledge of animals and relate to other beings as their community members.

Based on our interviews, it appears that people do not necessarily count time in the human body, but they do associate phenological events with physical events in the human body. So while the interviews in Sary Mogol did not garner conclusive evidence of the use of calendars of the human body, they demonstrated some clear connections between calendars of the human body and calendars being used currently in the community. The use of phenological events and

their association with the human body in the calendars of Sary Mogol is living evidence of them acting as ecological calendars.

The Islamic, Gregorian, and Kyrgyz Calendars

The calendar used in Sary Mogol is a consequence of historical, cultural, social, and ecological influences. Most interviewees told us that the new year begins on March 21st, or in Persian, *Navruz*, which the people of Sary Mogol associate with Islam. It was described to us as "the Muslim celebration", or "celebration of the new year." But it was also referred to as the new year "according to Muslim law" or as the time to perform *uchuk*, a healing ritual, or as the time to do housecleaning and to focus on renewal. This association of Navruz with Islam is an example of how the people of Sary Mogol can incorporate apparently disparate influences into their lives and reject dualism. It acts as a reflection of the critical posthumanist framework that I use. Some interviewees mentioned the "Russian" or Gregorian calendar in reference to the new year. When asked when the year begins for him, one younger man said that the new year begins on January 1st, but perhaps this was in reaction to being asked such a question by two Americans. One older woman very succinctly said, "In Kyrgyz culture we have Navruz. In Russian culture we have January. Navruz is the beginning of the year for me" (30). Two other interviewees also mentioned this dichotomy. While this could be interpreted as a way of incorporating new influences into their lifestyle, it does seem that the people of Sary Mogol see the two "beginnings" as distinct and separate. However, the specific wording of the statement could have been for the benefit of the two Americans asking questions. It may also be, as noted to me by Kassam, the result of their interest in distinguishing themselves from "the other." Increasing influence from foreign Islamic groups and from the Kyrgyz government since the dissolution of

the Soviet Union may be pressuring communities to assert their "Islamicness" or their "Kyrgyzness" through the rejection of other parts of their history.

When asked which seasons are part of their calendar, all participants listed *bar* (spring); *jas* (summer); *kus* (autumn); *kush* (winter). Each season is associated with different phenological events, for example, one participant described summer in the following way, "The surface of the earth becomes fully grown and alive. Water arrives, there is a very harmonious period. The people all have a good mood, there are sunny days. The rivers will be running more" (28). This statement also indicates that there are specific emotions or different ways of being associated with each season, much as Kassam et al (2011) describe how emotions are attached to comparable ecological events in the calendar of the human body.

The months of the Gregorian calendar also have a function in the calendar used by the people of Sary Mogol. When we asked one pastoralist about the signs of winter beginning, he simply said, "Starting in November there will be winter." When we asked agriculturalists about planting and harvesting times, they always answered with specific dates in the Gregorian calendar. The Gregorian calendar is not the only standardized calendar used in Sary Mogol however. Many interviewees also mentioned the Islamic calendar, which has twelve months and is based on the moon cycle. However, we were told repeatedly that the months of the Islamic calendar do not correspond with the months of the Gregorian calendar. The months of the Islamic calendar are as follows: *Muharram, Safar, Rabi-Al-Awwal, Rabi-Al-Thani, Jumada-Al-Awwal, Jumada-Al-Thani, Rajab, Shaban, Ramada, Shawwal, Zul-Qaadah,* and *Zul-Hijjah*. The Islamic calendar seems to be tied primarily to cultural and religious events, as interviewees never described agricultural activities in terms of the Islamic months. One participant articulated this clearly, saying, "I know the Islamic calendar, but it doesn't relate to my daily activities, unless

there is Qurban Eid or Ramadan. That is when we care about the Islamic calendar." Cultural and religious activities can be linked to agricultural activities however. For example, Qurban Eid requires the sacrifice of sheep which is dependent on agricultural activities. Also, one agriculturalist mentioned both the Russian or Gregorian calendar, and the Islamic calendar. He then went on to describe how after Navruz (which always occurs on the vernal equinox and is described in terms of the Gregorian calendar), migratory birds begin to arrive. However, while the Islamic months appear to be culturally valuable, they do not seem to be critical to daily life. A retired English teacher told us that the year begins on Navruz, and that there are Islamic months, but that she had forgotten them.

In Sary Mogol people recognize the four seasons and have names for each of them in Kyrgyz. However, they do not necessarily identify with these seasons. Much as people from northern New England list the winter season, the mud season, and the summer season as the components of their calendar, or attribute more than three months to the winter season, people in Sary Mogol have made adjustments to the four seasons. One person optimistically says, "we have five months of winter and seven months of summer" (39), while another says that winter lasts for seven, or sometimes eight months and that "the seasons are different each year (4). Another recognizes the potential futility of a calendar while drawing attention to the flexibility of the seasons, saying, "I don't know much about the *Kyrgyz aye* and I don't use it. In Sary Mogol you might see four seasons in one day" (14)." The language of one pastoralist is telling: "In Eastern Pamiri language we have four seasons. The hottest period of the year is called *saratan.* Right now, in July, it is *saratan* (meaning "cancer" or "crab" in Arabic). There are two periods: *saratan* (the hot period), and *childe* (the cold period)" (7). This statement gives some indication

that the four seasons are a bit of a formality, and that it is the actual manifestation of the weather that matters.

A third type of calendar factors into the story as well: the *Kyrgyz aye,* meaning the "Kyrgyz moon" or "month". We initially learned about this calendar from Kaziev, who described it as a "nation building" strategy developed by the newly independent Kyrgyzstan after the collapse of the Soviet Union. This may have been in reaction to the Russian language dominating the public sphere during the latter days of the Soviet Union (Fierman, 2009). According to Kaziev, the months of the Gregorian calendar were simply renamed in Kyrgyz. Three interviewees listed the months of the calendar that they remembered, many of which were compound words ending with the word *aye.* To many of our interviewees, the origin of the *Kyrgyz aye* was unknown. One interviewee said, "It could have originated from the beginning of Kyrgyzstan, but we've only been hearing about the *Kyrgyz aye* recently" (16). The retired English teacher recalled that the *aye* had only been promoted since after her retirement (18). Many others associated the *aye* with Navruz or with celestial events. Some interviewees told us that they had heard of the *Kyrgyz aye* but did not know anything about it. One woman attributed four seasons to the *Kyrgyz aye,* but said that in Sary Mogol there are two seasons: "the winter is harsh and we have short summers" (19). This is a clear distinction between the somewhat artificial construction of the *Kyrgyz aye* and the reality of the seasons in Sary Mogol.

Other Ways of Measuring Time

Within the multi-faceted calendar of Sary Mogol, there is yet another way of measuring time. During coding, I distinguished between several different types of time markers that were discussed in the interviews. These include: beginning or end of phenomenon; beginning or end

of season; cause and effect; cues; cue communication; sequence; and synchronies. These codes were adapted based on the previously developed ECCAP codes from research in Standing Rock in what is currently known as the American Midwest and in the Lake Oneida Watershed of what is called New York. After coding separate sets of ECCAP interviews (from different project sites), the research group reconvened to attempt to create a consensus on definitions and gain a joint understanding of how the codes were being used in each case. However, it soon became clear that while we could communicate to each other our definitions of each term, these definitions were not always applicable in other places. For example, one community of interviewees may verbalize the hibernation of an animal as a conscious communication to farmers to begin harvesting, while another community may see this only as a cue. In the case of Sary Mogol, it is also possible that some of these semantics were lost during translation. For the purposes of this paper, I have defined the previously mentioned seasonal markers as follows:

1) Beginning or end of phenomenon: the beginning or end of a seasonal phenomenon
2) Beginning or end of season: the beginning or end of a season as defined by an interviewee
3) Cause and effect: one seasonal phenomenon is attributed with the causation of another
4) Cues: cultural and phenological events that act as signs and result in action taken (e.g. a bird begins migration and an agriculturalist takes this as a cue to harvest)

5) Cue communication: communication from one being to another, acting as a sign and resulting in action taken (e.g. a herder tells an agriculturalist that the pastures are senescing, and they move their livestock out of summer pastures)
6) Sequence: a series of events
7) Synchronies: phenomena or events that occur simultaneously

These seven markers create a framework from which to describe the significant aspects of the ecological calendar in Sary Mogol. However, the markers themselves do not make the calendar. The calendar is ever evolving and embedded in personal and collective histories, and as such, the markers cannot stand alone. The markers take the form of celestial, human, non-human animal, plant, and abiotic beings, and their changes. We can further separate the human into religious, cultural, and agricultural activities/events, and the non-human animal into loose taxonomic groups and individual species and associated behaviors.

Indigeneity and Ecological Calendars

The 1939 paper "Nuer Time-Reckoning" by Evans-Pritchard examines the ecological calendar of one group, the Nuer. Evans-Pritchard makes a surprisingly value-free observation of differences in the measurement and use of time between different groups of people, saying:

> "The difference may, at first sight, appear to be one between a literary system of time reckoned in mathematical symbols and a verbal system not so reckoned. This is largely true when we compare the ways in which individuals use the systems, for

> Nuer and European alike speak of time in terms of changing social activities and relationships; and, herein lies the difficulty of the Nuer, or the European, thinking in the other's notions of time, because the social activities and structure of the one are very different from the social activities and structure of the other. They have different interests and therefore different time values" (p. 189).

Evans-Pritchard avoids making any qualifications of the use or measurement of time, merely pointing out that they are *different.* Within the paper, Evans-Pritchard distinguishes between "oecological time", or that relating to humans' environment, and "structural time", or that relating to humans' social structure:

> "All their time-concepts, it need hardly be said, are social notions, being man-made and referring to successions of events which are of sufficient interest to the community for them to be noted and related to each other conceptually. Nevertheless, those social activities which directly, or indirectly, concern the relations of men with their physical environment are of a different order to those social activities which relate men structurally to one another and time has therefore two movements, an oecological, or occupational, movement and a structural, or moral, movement." (p. 189-190)

As refreshing as this is for research from this era, I will step in and take Evans-Pritchard accountable for his uncritical view of humans' environment. By describing the "oecological" as a purely "physical environment", he is completely disregarding the biotic aspect. Regardless of

whether one considers "insentient" or "abiotic" beings: soil, water, rock, as simply part of a physical, inert backdrop lacking in agency, it cannot be ignored that there are other animal beings which behave of their own volition, and even fungi and plant beings which are living organisms. As Kassam (2009) points out in *Biocultural Diversity* "the word 'animal,' is derived from *animus*, meaning 'endowed with mind or spirit (Bateson 2002: 5)'" (p. 69). "By describing the oecological as an "occupational movement" separate from the structural or "moral movement", he is also denying the potential for other beings to have a more social or structural bearing in the lives of people. So while his treatment of the "other" human is progressive for his time, Evans-Pritchard falls short in recognizing the agency of other beings. In doing so, he also ignores the possibility for humans to have relationships with non-humans in a similar way to their relationships with other humans. In this paper, I lean on Evans-Pritchard's system, but I prefer to name the categories "human activities" and "non-human activities" in order to distinguish between groups without favoring one over the other.

Prober et al (2011) make a distinction similar to that of Evans-Pritchard, differentiating between the "structural time" of the Gregorian calendar and the "ecological time" of the indigenous calendar. However, Prober's definition of structural and ecological time is quite different. She describes structural time as "fixed" in contrast to "cyclical" ecological time (p. 2). Cochran et al (2015) describe the ecological calendar of the Tukano in the Brazilian Amazon as an "annual calendar cover[ing] cycles of fish, amphibians, birds, mammals, insects, plants, daily work in agriculture, fishing, gathering, and hunting, rituals and festivals, prevention and cure of diseases, diet and behaviors." The knowledge of Sary Mogol shares many of these attributes. Prober and Cochran are explicitly investigating what they term the seasonal knowledge of

Indigenous peoples. Is the calendar of Sary Mogol an indigenous ecological calendar, or more explicitly, are the people of Sary Mogol Indigenous?

The UN defines Indigenous peoples thus: “Indigenous peoples are inheritors and practitioners of unique cultures and ways of relating to people and the environment. They have retained social, cultural, economic and political characteristics that are distinct from those of the dominant societies in which they live. Despite their cultural differences, indigenous peoples from around the world share common problems related to the protection of their rights as distinct peoples.” (Indigenous Peoples at the UN, 2017). However, the UN Permanent Forum on Indigenous Issues factsheet declines from issuing an official definition of “indigenous” due to the “diversity of indigenous peoples” (Indigenous Peoples, Indigenous Voices, n.d.) The factsheet does, although, provide the following guidelines:

- Self-identification as indigenous peoples at the individual level and accepted by the community as their member.
- Historical continuity with pre-colonial and/or pre-settler societies
- Strong link to territories and surrounding natural resources
- Distinct social, economic or political systems
- Distinct language, culture and beliefs
- Form non-dominant groups of society
- Resolve to maintain and reproduce their ancestral environments and systems as distinctive peoples and communities.

The Kyrgyz of Sary Mogol have maintained their language, many traditions, and beliefs even through the difficulties of the Soviet Union. As I demonstrate in this paper, they retain a meaningful bond with the land they live on and with the many beings around them. They are also proud of their culture and their connection with the land (although they may be somewhat displaced from their more historical "territories and natural resources") and based merely on their interest in participating in this project, seem invested in these qualities. However, they do not "form non-dominant groups of society" within Kyrgyzstan. In fact, they are in the majority, with ethnic Uzbeks, Russians, Germans, Tajiks, Kazakhs and others living in the country as minorities (CIA Factbook Kyrgyzstan). However, the Kyrgyz do live as minorities in many other countries, due to pre-, circa, and post-Soviet displacement and diaspora. This aside, the most salient point in the factsheet is the first, that a person identifies as indigenous and that they are integrated into their indigenous community. This is somewhat difficult to measure without another dominant society existing in Kyrgyzstan, against which the Kyrgyz would perhaps more openly assert their indigeneity. However, it is important to not base the quality of indigeneity against a measurement of "the other." Indigeneity should not require the validation of colonialism. The Kyrgyz are indigenous because of their place-based knowledge, and not because of the measuring stick of the UN or other groups. However, I suggest that their knowledge differs from local knowledge of non-indigenous people because of two factors: time and language. The Kyrgyz have developed their knowledge over a much longer period than non-indigenous people, thus time is a factor. Also, the Kyrgyz language developed in conjunction with their place and place-based knowledge, which adds another layer of complexity to their knowledge.

However, we can also find evidence of the Kyrgyz participating in the greater world as indigenous people. According to an article in *The Diplomat,* Danil Mamyev, a Kyrgyz community leader, represented Kyrgyzstan at the IUCN's 2016 World Conservation Congress (Asia's Indigenous Voices, 2016). The article describes the Kyrgyz as the country's "first people" and "indigenous people". The article also points out that Kyrgyzstan faces many environmental threats, including logging, resource extraction, and poaching, and highlights Mamyev's commitment to protecting the land. Mamyev illustrates both his ownership of his indigeneity and a posthumanist place in the landscape, saying, "Governments around the world, and internationally at the UN level and IUCN, by making separate policies governing culture and landscape, they are essentially tearing indigenous people away from their traditional landscapes…We are unable to have that relationship with land that is an intrinsic part of our culture" (Ibid, para. 35). Based on this, I assert that the Kyrgyz of Sary Mogol are Indigenous, and that their knowledge and calendar incorporate indigenous knowledge. However, we also know that in Sary Mogol, both ecological and structural time are used.

LITERATURE REVIEW

Posthumanism

Posthumanism is an important part of the literature review as it is the critical framework upon which I build the thesis. Here I provide an overview of relevant posthumanist writing that exposes why I see this as the best theoretical backing for my work.

It is worth noting that the term "posthumanism" has been used in places where others would prefer "transhumanism" as well in a diversity of disciplines. In the book *Biopunk*

Dystopias: Genetic Engineering, Society and Science Fiction (2016) for example, Lars Schmeink uses posthumanism to describe the transcendent aspects of the human. While I, and others (to be elaborated on further in this section) might disagree with Schmeink's use of the term "posthumanism", I believe that he has developed some useful practices. For example, in an extensive footnote he criticizes the use of the word "we" in posthumanist writing:

> "In a book dealing with posthumanism, a few words on the use of the word 'we' are in order. As Bill Readings has rightfully pointed out (with reference to Lyotard's *The Differend)*, the use of 'we' in critical writing is deeply entrenched in conceptions of humanism and universalism, which need to be acknowledged because 'the homogeneous "we" is not innocent, […] its union of the "I" and the "you" is the domination of the sender or speaker and the suppression of the receiver or hearer' (118). Consequently, in a book promoting the idea of a posthuman, hybrid, multiple, and protean subjectivity beyond the values and mores of humanism, the use of a naturalized, universal 'we' obviously proves problematic. Neil Badmington suggests the use of quotation marks to signal such a problematic position (*Posthumanism* 1, note 3). Other writers of posthumanism (Wolfe, Braidotti) seem to have no such qualms, using the term without a mention of its humanist origin. I would like to use the middle position and proclaim that when using the 'we'… I am aware of its genealogy but reject any notions of universalism and/or discourses of domination that are implied in it" (p. 18).

In “Speciesism, Identity Politics, and Ecocriticism: A Conversation with Humanists and Posthumanists” (2011) Cole et al. recreate and elaborate on a panel discussion held at a meeting of the Group for Early Modern Cultural Studies. The conversation begins with a thorough and brilliant critique from Donna Landry. She points out that:

> “the very notion of discrimination is more complicated than it might appear, especially with regard to species not as a category of prejudice but as a category of knowledge, as in Marx’s concept of species-being or Charles Darwin’s notion of evolution of species. Although the category of species may be no less a construct than is sex or gender or race, to have zoological explanatory power, it must bear some relation to the actual qualities and requirements of the species in question, beyond mere prejudice” (p. 88).

Landry summarizes her stance succinctly:

> “Surely the point of animal studies in the humanities, or of books like *Animal Rites,* is not merely to displace, according to the imperatives of academic fashion, other critical-social movements, such as feminism, anti-racism, or postcolonial theory? For here is where an opportunity to do some real work - of articulation not trashing - (re)presents itself…” (p. 90).

This, I think, is a noble, or perhaps more appropriately, requisite thought process for any critical theorist. The other authors involved in the discussion address topics such as the

responsibility of scholars to educate others through critical conversation; the difference between conducting research focused on the species and focused on the individual; a caution against the human as "shepherd" of the "other" through the decentering of the human; the distinction between the Darwinian "ascent to man" and Lynn Margulis' 1990 theory of "multi-species co-evolution"; and the practical and theoretical issues with biocentrism (Cole et al, 2011). Overall, the piece is a great starting point for a critical conversation about posthumanist thought.

In "Humanisms, Posthumanism, and Neohumanisms: Introductory Essay" (2008), Massimo Lollini provides a historical overview of the three traditions. His review of the literature is concise yet exhaustive and biased towards humanism. Lollini begins with humanism and neohumanism, moving on to posthumanism later. It is telling, I think, that he titles the section on posthumanism with a question: "A Posthumanist Philosophy and Literature?", as if to say outright that he does not quite believe in the practicability or feasibility of this (p. 20). He does value posthumanism as a tool to re-evaluate humanism, however, asking: "To what extent then does posthumanism depart from the fundamental idea of *humanitas* and to what extent is it still inscribed within the tradition of humanism?" (pp. 20-21).

Gillian Whitlock makes me necessarily uncomfortable with a statement she makes in "Post-ing Lives" (2012). While I choose to use "I" to provide first-person narration to the point of including my field journal excerpts detailing *my* thoughts, emotions, and experiences, Whitlock criticizes this practice:

> "The absence of autobiography in mappings of posthumanism to date – and vice versa – is extraordinary. In her history of the field, Linda Anderson associates the formative autobiography criticism of the 1960s and '70s with an essentialist and

> Romantic notion of selfhood and authorship, and with the individualism and humanism of the European Enlightenment. Although some identify this subject as a straw man with a vastly simplified history (Adamson, Freadman, and Parker; Halliwell and Mousley), the point remains that in the recent past this "sovereign subject" has been the focus of criticism that questions the singular "I" of the autobiographical pact, the fantasy of embodiment that is reproduced without attention to gendered, racialized, and sexed identities, and modes of embodiment and recognition as these are understood in terms of western humanism. Feminism, postcolonialism, poststructuralism, queer theory, postmodernism, disability studies – all have influenced recent criticism by raising questions about the status of the human subject and subjectivity. What distinguishes posthumanism from these adjacent and associated critical practices is its primary and definitive concern with the limits of the human… The life of the autobiographical "self" is profoundly invested in the human. For this reason it is persistently haunted by its non-, in-, and sub-human other: the monstrous, the animal, the dead, the irrational, the primitive, the mechanical – these mark the limits of autobiography." (pp. v-vi).

While I agree with this, I choose to borrow Schmeink's (2016) technique of acknowledging the problematics of the term but disassociating from its humanist origins. I acknowledge that I cannot speak for the others of Sary Mogol. In fact, I cannot even speak for the people, so why make any pretenses? Instead, I speak for myself, and try to accommodate the "other" as much as possible without stealing their agency. Impossible this may be, but at the least it is a worthy goal.

Whitlock continues with an interrogation of humanist ideals and their relation to the posthuman, saying, "the posthuman does not mean the end of humanity or a turn to the antihuman, but it does offer resources for rethinking the liberal humanist view of the self, and it does signal the questioning of conceptions of the human that draw on hierarchies of speciesism and anthropocentrism…" (p. vi). She also introduces the concept of "zoegraphy", "a thinking on how to think and write a life that does not have any human body or self at it center" (p. viii). While this is something I think might be aspired to, it would be beyond the scope of this project, considering the amount of time and resources remaining, as well as the initial methods used. So I mention it here as a recommendation for the future but not as a method for the present.

The piece also distinguishes between "popular posthumanism" (which might be termed "transhumanism" by others) and "critical posthumanism". Whitlock posits that popular posthumanism is mostly concerned with the popular imagination: "bioengineering, avatars, mutations, cyborgs, and networks", while critical posthumanism "uses the 'post' as an opportunity to open up critical spaces for productive re-engagement with humanist ethics, epistemology, and ontology in worlds that we occupy in real time and space" (p. x). Her question, "What happens when agency is reframed in terms that theorize the human body as a porous ecosystem?" is another beautiful example of her ability to facilitate productive discomfort (p. x). I think that the most important point to take from Whitlock however, is that "critical posthumanism is an opportunity to reconsider conceptions of the self that have been the doxa of autobiographical narrative and critique to date…Autobiography is embedded in the personhood of western modernity, and posthumanism radically calls into question notions of matter, life, agency, and being that shape humanist understandings of this 'bios" (p. xiii). Again, while I attempt to adopt a posthumanist framework, I think that the closest I may accomplish is to

"reconsider conceptions of the self" (p. ix). It should also be noted that chronologically, posthumanism did not find me before my time in the field, so my fieldwork and field journal may not reflect posthumanist thought at all.

I could not write an effective review of posthumanist literature without including the work of Donna Haraway. Her work is committed to exposing inequalities and addressing their origins. In *Animal Sociology and a Natural Economy of the Body Politic, Part I: A Political Physiology of Dominance* (1978), Haraway so lucidly writes:

> "The degree to which the principle of domination is deeply embedded in our natural sciences, especially in those disciplines that seek to explain social groups and behavior, must not be underestimated. In evading the importance of dominance as a part of the theory and practice of contemporary sciences, we bypass the crucial and difficult examination of the *content* as well as the social function of science. We leave this central, legitimating body of skill and knowledge to undermine our efforts, to render them utopian in the worst sense. Nor must we lightly accept the damaging distinction between pure and applied science, between use and abuse of science, and even between nature and culture. All are versions of the philosophy of science that exploits the rupture between subject and object to justify the double ideology of firm scientific objectivity and mere personal subjectivity" (p. 22).

This passage is a reminder to me in *this* work to interrogate narratives of domination, to question my distinctions between "I" and "the other".

Indigenous Knowledge

Indigenous knowledge (IK) is the contextual knowledge of place held by indigenous peoples. Claude Levi-Strauss (1962) termed this traditional ecological knowledge (TEK), and called it the "science du concret", or the science of tangible, personal observation and experience (Berkes, 2012). However, as noted by Berkes (2000, 2012), indigenous peoples often reject this terminology due to the preservationist, or alternatively, backward values associated with the word "traditional". For this reason, I use the term "indigenous knowledge".

IK cannot be considered alone, however, as it cannot perpetuate without successful transmission. The transmission process is especially important to understand as IK is usually transmitted through oral histories (Berkes et al, 2000). While transmission is important, recent work has focused heavily on the pure preservation of IK, while ignoring that by nature, it is not static (Gómez-Baggethun & Reyes-Garcia, 2013). In "Reinterpreting Change in Traditional Ecological Knowledge" (2013), Gómez-Baggethun and Reyes-Garcia address the adaptability and fluidity of IK, and make a call to emphasize the importance of the change inherent to IK:

> "The idea that TEK systems are capable of adapting both to external changes and internal pressures has been a mainstay of human ecology for some time (e.g., Berkes *et al,* 2000). Yet by analyzing change primarily in terms of lost knowledge the usual research perspective tends to downplay the dynamic nature of TEK systems, and little emphasis is put in understanding particular changes in TEK as an adaptive response to new environmental, social, or economic conditions. Likewise, few researchers have examined how the causes of the loss of TEK (i.e., modernization, technology, schooling, or integration into the market economy to

name the most commonly mentioned factors) actually affect the mechanisms that allow societies to generate, regenerate, transmit, and apply knowledge. Consequently our understanding of how these processes affect the resilience of TEK systems and their capacity to evolve and adapt is still limited" (p. 643).

In "The Politics of TEK: Power and the "Integration" of Knowledge" (1999), Paul Nadasdy makes the potentially contentious argument that the attempt to integrate different knowledge systems may often work against efficient collaboration, rather than towards. However, Nadasdy's interpretation of this difficulty has less to do with the actual integration of knowledges and methodologies than it does to do with oversights in building relationships. This is examined in the following passage:

"The assumption is that since traditional knowledge is expressed in a form that is vastly different from, and largely incompatible with, that of science, there are a whole host of essentially technical problems that accompany the effort to integrate them. Most of these problems relate to difficulties in accessing and collecting TEK or with translating it into a form that can be utilized by resource managers. This approach views the present lack of progress towards integration as resulting from the complexity of these problems and the difficulty in developing strategies and methodologies capable of effectively dealing with them. This official type of explanation, by focusing on the "integration of knowledge systems" as a technical problem, is inadequate because it ignores the political dimensions of the issue of knowledge integration. Rather than merely assuming, as many do, that integrating

> traditional knowledge with science will automatically lead to improved resource management and aboriginal empowerment, we must closely examine the assumptions underpinning this project…" (p. 2).

Nadasdy's paper is a reminder to be critical of the process, regardless of the "validity" or popular view of the methods being used. While multiple knowledges are central to this work, it is important that we interrogate the process and question to whose benefit IK is being used. Nadasdy also brings posthumanism (examined further in this literature review) to the forefront, saying, "in the absence of a strict separation between humans and the environment, the very idea of separating 'ecological' from 'non-ecological' knowledge becomes nonsensical" (p. 4). This encourages me to interrogate my methods of organizing interview data based on a "splitting" approach, as I attempt to separate the cultural from the ecological. I distinguish between the cultural and the ecological for ease of organization during coding, however, I attempt to reintegrate the two during analysis. Nadasdy later continues in this vein by interrogating "the compartmentalization of TEK" (p. 5).

The Pamir Mountains and Other Mountain Communities

Hermann Kreutzmann is one of the relative few contemporaries to write about the Pamirs. His work focuses on transformation, ethnicity, boundaries, and marginalization in mountain communities. In "Transformations of High Mountain Pastoral Strategies in the Pamirian Knot" (2009), Kreutzmann provides an overview of the transition that Kyrgyz and Wakhi pastoralism has undergone from pre-colonialism to the present. He outlines five examples of sociocultural challenges for pastoralists: Soviet sedentarization programs; competition

between nomads and mountain farmers in the Pamirs; transformation of Kyrgyz pastoral strategies in Kara Köl; the Kyrgyz exodus from the Afghan Pamirs; and Wakhi mountain farmers. In the first example of this section he even references the Kyrgyz of Sary Mogol, pointing out that they had to choose by 2004 whether to become citizens of Kyrgyzstan or Tajikistan. The people of Sary Mogol had long transcended boundaries, and now cannot even transport fodder across state borders.

In this piece, both Russian and British powers are held accountable, along with their view that the colonialization of Central Asia was critical to progress, epitomized by Rudyard Kipling's conception of "the white man's burden" and the corresponding ideas of Russia's Fyodor Dostoevsky. He continues on to describe "The Great Game" between these two powers, and the writing of twentieth century geographers such as Ellsworth Huntington. Kreutzmann includes the following telling paragraph from Huntington:

> "The nature of human geography may be illustrated by an example. Some of the Khirghiz of Central Asia are wandering herdsmen, or pastoral nomads, who live in the Great Tian Shan Plateau of Central Asia in summer, and descend to the valleys and the lowland plains in winter. They are densely ignorant and superstitious. So low are they in the scale of civilization that they know almost nothing of manufacturing, science, or art…They eat their meals with their fingers from the common dish, while sitting cross-legged on the bare ground or on the woolen rugs which are the most beautiful of their few manufactures… According to our standards the Khirghiz are dirty, lazy, and unprogressive…On the south the great deserts of Chinese Turkestan and the huge desolate plateau of Tibet separate the

> Khirghiz from India and all outside influences in that direction. On the east and west they are also shut in by deserts so that they come in contact only with nomads like themselves… Only toward the north, where the desert is less severe, do the Khirghiz come in contact with a civilized people, the Russians, but even that contact is slight. Thus isolation is the keynote of the Khirghiz location (Huntington and Cushing, 1924: 12)(p. 104)."

With this excerpt Kreutzmann demonstrates both the historical struggle of the Kyrgyz people to maintain autonomy of their culture as colonialist societies encroach, and the ubiquitous racism that accompanies historical ethnographies in the region.

Kreutzmann adds another excerpt from Huntington:

> "The Khirghiz are not savages, but the gulf between them and the more enlightened nations is growing wider. The influence of European civilization has begun to reach them, *but their mode of life will probably change only a little so long as they depend chiefly upon grass of the plains and high plateaus* [emphasis added] (Huntington and Cushing, 1924:21) (p. 105)."

Kreutzmann utilizes this passage to point out the backwardness that has long been and still is associated with nomadism. What he does not explicitly critique however, is that Huntington is not really speaking about nomadism. The issue is much greater and did not end when Huntington and his contemporaries faded away. The problem that Huntington exemplifies, and that persists, is that we devalue the connection between ourselves and those around us: the

plants, soil, water, fungi, other animals, and even other people. In the passage from Huntington, it is clear that there is a direct correlation in his mind between disdaining reliance on one's extended community for subsistence and the "enlightenment" of an individual or society. This idea of "progress" needs to be thoroughly deconstructed before we can move beyond Huntington.

The final chapter of Tom Wessels' 2010 book, *Myth of Progress: Toward a Sustainable Future,* is titled "The Myth of Progress: A Need for Cultural Change. I find that this clearly addresses the Huntington problem. It is not the culture of the Kyrgyz that ever needed to change, nor is it their connection with community that needs to change. It is the pervasive idea of "progress" that must be examined, especially reflexively by those in the scientific community. Wessels utilizes the beautiful example of mycorrhizal connections in forest communities to promote a type of progress "in which our attention, compassion, and empathy grow ever-outward to benefit our communities and society as a whole" (p. 68). While Wessels admittedly tends towards glorification of what he terms "ancient cultural values", his intention is honest.

To temper this unquestioning enthusiasm, we might look to the work of Craig Childs. In "House of Rain: Tracking a Vanished Civilization across the American Southwest" (2006), Childs addresses violence in the pre-Columbian First Nations people most commonly known as the Anasazi. He attempts to deconstruct the glorified image we often perpetuate today of First Nations people. Perhaps in response to some negative reviews, he wrote an opinion editorial for The New York Times, "A Past That Makes Us Squirm" (2007). In this piece, he clarifies that in "House of Rain" he is not making a criticism of First Nations peoples, but that he is exposing the racism behind the critical eye. He asks: "How do we rectify the age-old perception of noble and peaceful native America with the reality that at times violence was coordinated on a scale never

before witnessed by humanity? The answer is simple. We don't" (para. 9). Childs then rounds up loose ends, criticizing reactions to a movie portraying pre-Columbian Mayans:

> "If "Apocalypto" has a fault, it is not with its brutality, but with us in the audience who cringe, thinking the Mayans little more than a barbaric people. The fault lies in our misunderstanding of a complicated history, thinking we can lump a whole civilization into a single response and walk out of the movie saying, 'That was disgusting'" (para. 11).

Let us return to Kreutzmann: his piece, "Ethnic Minorities and Marginality in the Pamirian Knot: Survival of Wakhi and Kirghiz in a Harsh Environment and Global Contexts" (2003) is again critical of the concept of mountain communities as static and unprogressive, using examples from Afghanistan, Tajikistan, Pakistan, and China. Kreutzmann makes an argument against the idea that mountain communities are "regions of refuge" as proposed by Skeldon (1985). He begins by detailing early research in the area, describing the region and the people, and then describes the changes that pastoralism has undergone due to political and economic forces, and the changes that pastoralists have made to adapt. Kreutzmann uses the Wakhi and the Kyrgyz as examples of adaptation strategies in both sedentary and nomadic agricultural systems. This is a beautiful example for the purposes of this work, as the Kyrgyz of Sary Mogol are Kyrgyz people, and while they still practice aspects of nomadism, they share much in common with the sedentary Wakhi.

The third and final Kreutzmann paper that I would like to address is "Development Indicators for Mountain Regions" (2001). Kreutzmann appropriately recognizes that new inter-

and transdisciplinary approaches are needed, and that mountain regions are unique and require unique methodologies. He also points out that indicators such as quality-of-life measurements assume universals while ignoring that different cultures have their own value systems. However, he is still very much attached to the idea of progress that I take issue with. For example, Kreutzmann writes, "The extent of formal education in mountain communities indicates their participation in a "modern" social infrastructure. In peripheral regions, this aspect of integration is crucially important to the future development of livelihood strategies" (p. 136). While I agree that this may be true and is an important consideration, especially in areas like Sary Mogol that already partially rely on tourism and industry, this statement is too generalized and disjunct from any other literature for a full appreciation of his argument. He then recommends three strategies to be incorporated into high mountain development research: 1) Territorial appropriation, settlement strategies, and population change; 2) Entrepreneurship and livelihood strategies; 3) Resource management and energy supply. Finally, he reiterates the need for a re-examined quality-of-life indicators system. Again, while I appreciate the relatively forward-thinking approach and healthy examination of the word "modern" from Kreutzmann, I believe that we need to make even more radical changes in how we examine changes in mountain communities.

Christoph Bergmann and Martin Gerwin's piece, "Towards a Political Ecology of Scale in High Mountains" (2012), addresses these issues more completely. These researchers give credit to a methodology (Bergman et al. 2011) that addresses mobility in mountain communities in three ways: "1) Its spatial and temporal organization; 2) The narratives and discourses that different actors attach to such patterns when drafting policies, fixing routes, or scheduling tasks; 3) The lived and embodied practices and rhythms of seasonal movement" (pp. 69-70). Bergmann and Gerwin recognize that mountain communities live in different planes, namely, the

"institutionalized" and the "ritualized", and that both affect the people's relationship with their environment (p. 71). They also briefly address the significance of borders. In Sary Mogol, this is particularly relevant, as many of its residents came from Tajikistan, and have had to choose between their new home and their old one.

Nazneen Kanji et al. also speak to quality of life in Central Asian mountain communities in their 2012 paper, "Improving Quality of Life in Remote Mountain Communities: Looking Beyond Market-led Approaches in Badakhshan Province, Afghanistan". They look specifically at the quality-of-life indicator system initiated by the Aga Khan Development Network (AKDN), and based on the work of Amartya Sen, which promotes the measurement of peoples' "capabilities" over their "utilities" (p. 353). Kanji et al best describe the issue with most quality-of-life assessments in the following passage: "Development policy has long tended to emphasize the material dimension and has underplayed the importance of relationships and people's own perceptions. This leads to a view of development that is not rounded nor aligned with people's own lived experience" (p. 353). The authors also tested which sectors people value most in their own lives, and the results included livelihoods and the household economy, the natural and built environment, health and education, social and cultural life, and voice and representation.

There also exist several practical articles regarding critical engagement in Central Asian mountain communities. "Mountain Communities in Central Asia: Networks and New Forms of Governance" (Nikonova et al, 2007) details The Global Mountain Summit and The Conference of Mountain Communities for Sustainable Development, which are bringing the voices of mountain peoples to the table. Goals include increasing local governance and enhancing international cooperation, with the expectations of exchanging experiences and defending the interests of mountain communities. A paper published in *Mountain Research and Development*,

"The University of Central Asia: Generating, Harnessing, and Applying Knowledge About Mountain Societies" (Dhanani & Nowrojee, 2010) highlights the similar goals of the UCA to "promote sustainable development through education; help to build skills in mountain communities; promote biodiversity; encourage scholarship; foster partnerships; and make knowledge accessible" (pp. 302-303). "Engaging Researchers and Communities to Generate Knowledge and Action in Mountain Societies" (Weyerhaeuser & Nowrojee, 2014), is another call to action in mountain communities in Afghanistan, Tajikistan, and Kyrgyzstan from the Mountain Societies Research Institute (MSRI) of the UCA. They provide financial and intellectual support to researchers, particularly female researchers, from these countries. They also conduct practical projects that directly support mountain communities, such as eBilim, which brings books, laptops, and a digital database directly to ten Kyrgyz mountain communities by bus. Another project implemented by MSRI is the Learning Landscape Initiative, which focuses on "generating knowledge and demonstrating how it is (or is not) used in adaptive decision-making processes at household, community, and government administrative levels" (p. 411). The parenthetical is critical: it is a reminder to this research to question if the knowledge that I collect and compile is useful or not to the community.

In "Making a Living in Uncertainty: Agro-Pastoral Livelihoods and Institutional Transformations in Post-Socialist Rural Kyrgyzstan", Bernd Steimann outlines the transition out of socialism and collective farming, including details on the actors and current livelihood disparities between them. His main objective is to: "examine current agro-pastoral livelihoods in rural Kyrgyzstan and related processes of change, i.e. how households and individuals make a living today and how they have coped with processes of post-socialist transformation since the late 1980s" (p. 2). His introduction to the book is a familiar story to me: during field research, he

encountered herders who complained of the effects of a new mine on their water supply and pastures. However, he also noted that people, including herders, from this community were employed at the mine and sold consumables to the mining company. Steimann addresses this phenomenon, citing reasons other than the obvious one of income (p. 1). Much as I did, Steimann also only noted this issue towards the end of the field season and was unable to investigate it thoroughly. Steimann addresses other issues, such as the lessened mobility resulting from Soviet restructuring which has led to over-grazing and pasture degradation (p.6).

While there are few people writing about the Pamir region, we are fortunate enough to have access to a paper written specifically about Sary Mogol. Christian Sonntag's 2016 paper, "The Nexus of Settlement Development and Today's Energy Use in Sary-Mogol, Alai Valley, Kyrgyzstan" is not only an investigation, but an extensive compilation of data concerning Sary Mogol. Sonntag subscribes to a "vulnerability as agency" approach (p. 154). He cites work such Bohle's 2007 "actor-oriented analytical concept" to defend the actions of those who are vulnerable (p. 154). Sonntag's methods involved 57 semi-structured household interviews, 25 qualitative interviews with various "experts" of different occupations, and 13 biographical interviews with elders, as well as participant observation, energy use calendars, and mapping. Sonntag tracks the transition in energy use in Sary Mogol from dried dung and woody plants to coal from the circa 1996 mine. He describes the socioeconomic status of most households in Sary Mogol as "precarious" and details the existing inequalities.

However, my personal favorite of all works centered on Central Asian mountain communities is "Kyrgyzchylyk: Searching New Paradigms for Ancient Practices" (2008) by Gulnara Aitpaeva. Aitpaeva describes her mission to establish the first "social-science-based anthropology" through participatory action research in Kyrgyzstan (p. 67). In this paper, she

examines *kyrgyzchylyk,* or "Kyrgyzness and defined as the totality of definite characteristics and qualities inherent to Kyrgyz ethnicity" (p. 71). Through *kyrgyzchylyk,* Aitpaeva examines a revival of spirituality in Kyrgyzstan, and gives insight into how the Kyrgyz people define themselves. Aitapaeva writes, "The overwhelming majority of traditional practitioners or *kyrgyzchylyk* bearers consider themselves Muslims and combine without conflict the ancient values with Islamic norms. And the Islamic norms are as traditional to them as the pre-Islamic ones" (p. 77-78). My observations were much the same: the people of Sary Mogol identify as Muslim, and this is not in conflict with their other ways of being in the world. For example, people in Sary Mogol eat horse meat. While the Badakhshani people we met in Tajikistan abstained from donkey meat and were even appalled by the idea of eating horse or donkey, this is because sheep and goats were far more sustainable in large numbers for their relatively small and sensitive mountain pastures. For this reason, donkeys have the very specific role of pack animals in the difficult terrain of the high Pamirs, do not need to be relied upon as a food source, and so are not halal. However, in Sary Mogol, the Kyrgyz share a much longer cultural and spiritual history with horses than with Islam, even having relied on them as a food source. So when I asked Kaziev if horses are halal to the Kyrgyz of Sary Mogol, he simply said, "they have to be" (4).

In "Assessing the State of Sustainable Land Management Research in Kyrgyzstan and Tajikistan" (2013), Dear et al criticize the Soviet agricultural standards for failing to incorporate social and political land use dynamics into their assessments. They contrast this with sustainable land management (SLM) which is being pursued in the region and conduct an analysis of papers written about SLM research in the area. However, they also find a disjunct between research, practice and policy in SLM research in the region, and advocate a more integrated approach.

This system break is attributed to the failure to incorporate community members fully in the research, possibly due to the limitations of time and language. These factors certainly frustrated our attempts to bring participatory action research into our work. Dear et al also point out the dearth of research co-authored between academic and non-academic organizations in the region, being a mere 19.8% of the papers they analyzed. While the authors acknowledge the difficulties of implementing multi-stakeholder research and knowledge sharing, they rightly hold researchers and national governments accountable for these shortcomings.

In Sary Mogol there exists one family of Wakhi Tajik origins. These people practice a different sect of Islam, traditionally have different subsistence techniques adapted to the region they come from, and even speak a different language from the native Kyrgyz who live with them. Delia Rahmonova-Schwarz's 2009 paper, "Transnationais on the Margins of Development: Badakhshani Tajiks in Southern Kyrgyzstan" addresses this phenomenon through a case study in Osh, not far from Sary Mogol. Rahmonova-Schwarz describes the unique situation of Badakhshani Tajiks who were relocated to Kyrgyzstan as labor migrants, and later became part of an "accidental diaspora", when the dissolution of the Soviet Union discouraged them from returning to Badakhshan, while compelling many to immigrate to Russia for employment (p. 58). She also details the difficulties that many Badakhshanis experience when they want to return to Tajikistan, citing the example of a family who was planning on settling in the country's capital, Dushanbe, without realizing that they might be discriminated against as a minority even in their home country, where most people are Sunni rather than Ismaili, and speak Tajik instead of Badakshani.

In "Changing Systems, Changing Effects – Pasture Utilization in the Post-Soviet Transition" (2012), Andrei Dörre and Peter Borchardt describe the changes that pastoralism in

Kyrgyzstan has undergone since the dissolution of the Soviet Union. They cite a continued degradation of pastures closer to settlements and a decrease in degradation of the more distant summer pastures. This degradation is attributed to multiple factors including socioeconomic status, laws and regulations, and resource management practices. This type of research informs my inquiry into the effect of mining on pastureland in Sary Mogol.

Finally, this literature review would be incomplete without the work of Karim-Aly Kassam. His 2010 article, "Pluralism, Resilience, and the Ecology of Survival: Case Studies from the Pamir Mountains of Afghanistan" asks how pluralism can aid resiliency in "coupled socio-cultural and ecological systems" (p. 1). While this question is relevant to my work, I choose to reject the word "coupled" in my own description of a Pamir community, as it does not serve a posthumanist argument. However, Kassam does acknowledge that to the Pamiris, "the dichotomy between nature and culture is not relevant" (p. 2). Kassam, like Hans-Georg Bohle who is mentioned further in this review, gives credit to communities by emphasizing their resiliency in a context of vulnerability. Most importantly, Kassam details the resilience that diversified livelihood practices, in this instance the pastoralism of the Kyrgyz and the irrigated crop systems of the Wakhi, increases resilience in vulnerable situations. Overall, the paper is a comprehensive history of the various actors in the region and their interdependence.

In "Viewing Change Through the Prism of Indigenous Human Ecology: Findings from the Afghan and Tajik Pamirs" (2009), Kassam investigates pertinent concerns in the region such as food sovereignty, opium addiction, natural resources, and infrastructure, many of which are relevant issues in Sary Mogol. Here, Kassam demonstrates that pluralism and local knowledge fill the vacuum left in the wake of the Soviet Union to provide for the people of the Pamirs,

saying, “these communities have not adopted a vocabulary of victimhood. Instead, they seek meaningful solutions in order to live” (p. 687).

In “Medicinal Plant Use and Health Sovereignty: Findings from the Tajik and Afghan Pamirs”, Kassam et al (2010) emphasize the importance of not merely health security, but health sovereignty: the ability for people to choose their healthcare, for example, plant medicine or folk medicine versus medicine derived from hypothesis-based science. This is another example of the diversity of knowledges contributing to resilience in the Pamirs.

Vulnerability

Returning to Kassam (“Pluralism, Resilience, and the Ecology of Survival: Case Studies from the Pamir Mountains of Afghanistan”, 2010) and Sonntag (2016), their addressing of vulnerability is important and deserves elaboration. Although published in 1995, Jesse Ribot’s “The Causal Structure of Vulnerability: Its Application to Climate Impact Analysis” is still a relevant examination of why certain individuals or groups are vulnerable. He criticizes climate impact analysis that does not address the root cause of vulnerability. He provides the example of a climatic event such as forest die back, and the multiple associated consequences such as soil erosion, forced sales of assets, and dislocations. Ribot’s criticism focuses on how this one-dimensional climate impact analysis does not include a “vulnerability analysis” which instead focuses on the *multiple* causes of these consequences. This is particularly relevant in Sary Mogol, where climate does have consequences for the entire community, but as noted by Sonntag (2016), certain people will experience the effects in a more pronounced way.

In “An Integrated Assessment of Vulnerability to Glacial Hazards: A Case Study in the Cordillera Blanca, Peru” (2008), Esther Hegglin and Christian Huggel address the issue of

uneven vulnerabilities to glacial hazards. They are concerned with projects that work only towards risk reduction without engaging the socioeconomic issues that make some more vulnerable than others. They design an approach that incorporates physical vulnerabilities with social vulnerabilities and implement it in a case study in the Cordillera Blanca. Although they encounter difficulties such as the cohesive merge of qualitative and quantitative data and the lack of interest coming from regional governments, Hegglin and Huggel present a clear case for a multi-faceted methodology for addressing vulnerability.

I would be remiss to not mention the work of Hans-Georg Bohle in this section. His 2007 paper, "Geographies of Violence and Vulnerability: An Actor-oriented Analysis of the Civil War in Sri Lanka", specifically addresses violence and vulnerability. While violence might not appear to be a theme in the story of Sary Mogol, Bohle's definition [borrowed from Galtung 2003, p. 3] outlines structural and cultural violence in addition to physical violence. His definitions are concise:

> "Structural violence has political, economic and cultural dimensions. In political terms, structural violence means to deprive people of freedom. In economic terms, structural violence is to deny people their basic needs. Culturally, structural violence means to deprive people of their own culture" (p. 130).

Structural violence certainly occurred in a cultural context during the Soviet period in Sary Mogol. People were forcibly relocated, made to relinquish their nomadic pastoral lifestyle and to reject Islam. Today, while the people of Sary Mogol have cultural freedoms, it might be argued that they are experiencing economic structural violence.

Bohle's approach towards "actor-oriented" research is also particularly relevant. Bohle says:

> "In these struggles, however, the vulnerable are not mere victims, but they possess a lot of agency. They constantly try to cope with violent threats to their livelihoods, they deliberately adapt to the shifting regimes of violence, and they always seek to negotiate options that help to secure their livelihoods" (p. 130).

These authors highlight the important tenet that while a group may be vulnerable, it is critical to recognize their agency. This is relevant even in Sary Mogol, where relative access to markets may belie the vulnerability of a people who are yet very reliant on subsistence agriculture.

Climate Change and Phenology

Roman Bohovic and Petr Dobrovolny's 2013 paper, "Vegetation Phenology in Central Asia by the Means of Remote Sensing" highlights the difficulty of conducting research based on remote sensing, particularly for areas where high resolution data may not be available. They find that while there are resources allowing for a long-term comparison of phenology change, they must be understood only as relative indices. This emphasizes the exacerbated uncertainty that climate change effects might have in places more neglected by remote sensing, such as the Pamirs. In spite of these difficulties in remote sensing, other methods have elicited results that point towards concerning trends. Kariyeva et al's 2012 paper, "Impacts of Climate Gradients on Vegetation Phenology in Central Asia" finds general increasing spring temperatures leading to

earlier start and peak dates of vegetation, a lengthening growing season, and decreased vegetative productivity.

Theoretical Background

The following section might be considered extraneous, but I see it as critical to the reflexivity of this work. As a researcher, I see it as my duty to critically interrogate my own biases and influences, my own background and how it might influence the research. During my graduate training, my advisor, Dr. Karim-Aly Kassam, impressed upon me the importance of "contextualizing the researcher". I save the reader this trouble and critically examine my biases and motives in the following section. I first refer to Creswell's (2004) definition of qualitative research:

> "Qualitative research begins with assumptions and the use of interpretive/theoretical frameworks that inform the study of research problems addressing the meaning individuals or groups ascribe to a social or human problem. To study this problem, qualitative researchers use an emerging qualitative approach to inquiry, the collection of data in a natural setting sensitive to the people and places under study, and data analysis that is both inductive and deductive and establishes patterns or themes. The final written report or presentation includes the voices of participants, the reflexivity of the researcher, a complex description and interpretation of the problem, and its contribution to the literature or a call for change."

The point that I would like to emphasize here is that the final product is both a result of the participants' voices and the researcher's influence or interpretation. I cannot write a transparent and valuable piece without considering my subjectivities, preconditioning, and influences to those evaluating this. My aim to expose and explore how my situation in this place affects the outcome of the research.

Cresswell and Poth (2018) outline four philosophical assumptions that should be acknowledged within a project, and which are addressed in different ways depending on which interpretive framework is employed: ontology, or the nature of reality; epistemology, how knowledge is defined and claims are justified; axiology, or the role of values in research; and methodology, or the process of executing research (pp 19-22). I will examine each of these four assumptions in terms of this project, and through my chosen interpretive framework of *critical posthumanism*.

What ontological beliefs do I advance in this story of Sary Mogol? I refer to Braidotti and her call to adopt "caring disidentification from human supremacy." Her proposed ontology is a "re-grounding of subjects in the radical immanence of their embodied and embedded locations", a "neo-materialist monistic ontology." She summarizes the ontology thus:

> "Human subjectivity in this complex field of forces has to be re-defined as an expanded relational self, engendered by the cumulative effect of social, planetary and technological factors (Braidotti 1991, 2011). The relational capacity of the post-anthropocentric subject is not confined within our species, but it includes non-anthropomorphic elements: the nonhuman, vital force of Life, which is what I have coded as *zoe.* It is the transversal force that cuts across and reconnects previously

> segregated species, categories and domains. *Zoe*-centered egalitarianism is, for me, the core of the post-anthropocentric critical turn: it is a materialist, secular, grounded and unsentimental response to the opportunistic trans-species commodification of Life that is the logic of advanced capitalism."

For example, as a non-member of the plant, animal, and other non-human groups, I can attempt to approach them from a posthumanist stance. I admit that my human eye sometimes leaves me hovering in my description of these beings somewhere between anthropomorphism and the definite "other", which occasionally and inevitably devolves these "others" into the "lesser." This is exactly what Braidotti proposes we reject. So while I do integrate the inevitable categories of human and non-human, animal and non-animal, sentient and insentient into my codes and descriptions, I aim to ultimately reject these categories, and I do subscribe to Braidotti's desegregation of life forms. As Cresswell and Poth (2018) write, the intention of the interpretive framework is to "respect individual differences rather than employing the traditional aggregation of categories."

What constitutes knowledge, and how are these knowledge claims justified? Or in the tradition of Hesse-Biber in her chapter, "Feminist Approaches to Mixed Methods Research", we can ask, "*who can be a knower?"* (p. 171). The concept of valuing multiple ways of knowing is integral to this project, so I value each interviewee's, and each researcher's reality. However, categories are useful and even necessary tools for comparison, and classification inevitably plays a role in this work. The question of *who can be a knower* compelled us to interview people in different roles. As described in the methods section of this work, while we first sought out those in stereotypical "knower" roles: elders, men, people engaged in agriculture, and community

leaders, we interviewed equal numbers of men and women, and interviewed young people, and people of other occupations such as storekeepers and event coordinators.

A looming difficulty of this epistemology however is that we are attempting to synthesize one ecological calendar for a group of people who may have answered the same question in a myriad of ways. How can we attribute equal value to two contradictory claims? Within the scope of this paper, the information is presented in a synthesized calendar in addition to some observation that might explain the discrepancy. It might also be attributed to a translation or transcription error. The claims could also be contradictory due to differences in individual practice based on factors such as microclimatic variation, as described by Ruelle and Kassam (2011). Of course, it is even possible that one individual simply might be wrong in their statement and it will not be devastating to those reading this paper. But what if we are using this information to create a tool to be used by a community of people? Then, knowledge claims take on a new responsibility. They are not simply words on paper, they become actions that people perform daily, actions that influence each person's ability to grow food, or raise livestock. How then do we know reality? One solution is validation of information with informants. If contradictions persist, the next option might involve bringing dissenting parties together for discussion. Or as mentioned by Ruelle and Kassam (2011), the acknowledged discrepancies can bring value to a community's knowledge base by recognizing the diversity of praxis.

What axiology do I employ, or what are the roles of values in this research? As just another person, animal, and being, I bring my own values into the work. As a person who has done work in other Central Asian countries (Mongolia and Tajikistan) prior to engaging in research in Kyrgyzstan, I inevitably entered this place with certain expectations or assumptions about it. My journal entries noted similarities between Kyrgyzstan and Mongolia. My previous

experiences in these similar places may have influenced me to ask certain questions and not others. They might have given me a confirmation bias, allowing me to see certain behaviors which I expected, while shrouding others. Or my previous experiences could have provided me with something against which to contrast and compare what I saw in Sary Mogol. As a researcher who has a curiosity of and interest in indigenous knowledge and Central Asia, I may have had an uncritical eye for certain aspects of Sary Mogol and my interactions with it. I might have been influenced by implicit racial, ethnic, cultural, religious, and classist prejudices.

I am a female-bodied, white, Euro-American, lower class, feminist person from a rural, conservative background. In a sense, I rejected a relatively similar lifestyle to that of many of our interviewees. Rejecting norms, I chose to not remain in my hometown, to not have children immediately after graduating high school, to not rely on the land for a living. What assumptions did I make about the people of Sary Mogol? Was my perception of them clouded and classist? Did I even harbor some incongruent nostalgia for a sense of home, recognizing the same archetypes here as I did in my hometown? As a female-bodied feminist person, some aspects of Sary Mogol may have triggered a strong negative reaction, especially if they elicited associations with my conservative background. My education has involved home education and public schools, undergraduate training in natural sciences with a transcendentalist influence, and graduate research. This relatively unconventional training has allowed me to explore and appreciate different ways of knowing. My work experience has ranged from carpentry and milking on dairy farms to ornithological and botanical field work. This former type of work is not so different from what people in Sary Mogol rely on for a living. I understand what it means to depend on your livestock, I know how the body and mind feel after doing hard labor and engaging with the “outside.” These experiences have embedded my being in the materiality of

place. During years of field work and living in tents I engaged in the process of learning about, observing, and participating in the intimacies of the lives of different plants and animals. Through this, I developed what one might consider a preconditioning towards transhumanist practice.

This has been a fairly comprehensive list of influencing factors, however, there is one final piece of myself to expose: why am I doing this work? I have long been interested in indigenous and local knowledge, and a personal practice of foraging, herbalism, hunting, and associated storytelling led me to a curiosity of their origins and practicalities in the present. This interest, however, is not a completely innocent one. Within the so-called "primitive skills" and ethnobotany communities that I have been a part of there is an undeniable nostalgia for something lost. There is a tendency to revere "traditional cultures", which leads to a system of shaming indigenous groups. When white folks like myself adopt ancient techniques that might be a luxury for indigenous groups to be able to practice, we often are guilty of ignoring our privilege. With this can come a blaming mentality where white folks criticize indigenous groups for losing or rejecting their traditions, without examining our own culpability. I too, have participated in this. For example, I used to advocate for a preservationist attitude towards indigenous knowledge, rather than the conservationist stance I hold now. Preservation of indigenous knowledge is blind to the following: that indigenous peoples may not want or need to practice a part of their IK any longer; that indigenous peoples may be discriminated against by white people for practicing IK; and that white people may have stolen land, resources, or relationships that allow indigenous peoples to practice certain aspects of IK. While I attempt to reject this way of thinking in my current and future work, I acknowledge here that it has been a part of my past.

Finally, what methodology do I employ? The analysis of the ecological calendar data occurs through a grounded theory approach. Cresswell and Poth (2018, pp. 83-84) list the defining components of grounded theory: it is centered around a process or action; a theory is developed based on this process or action; interviewing and memoing are integral to the research process; and coding within categories. I include two other short analyses about a coal mine and transhumanist thought in Sary Mogol, and these have been written as phenomenological studies. Broadly, the grounded theory analysis focuses on perceiving and measuring time in Sary Mogol, particularly in relation to subsistence activities and in light of climate change. The data was analyzed through writing memos during the interviewing process, in the field on my own time, and while coding. Coding was inductive and primarily *open:* creating categories and searching for subcategories upon which to elaborate; and *selective:* connecting categories (Cresswell and Poth, 2018, p 87). I particularly rely on the work of Charmaz (2006, 2014) and her constructivist grounded theory. Constructivist grounded theory provides an "interactive" process during which the researcher is constantly asking new questions and examining old ones (Charmaz, 2017). Reflexivity through questioning and criticizing the work is an important piece, and eventually, validation with participants will also occur. Unfortunately, as this is the result of an MS project and my funding ends upon graduation, I will not be able to validate the material myself. However, it is a part of a greater project and I anticipate the data being validated by other members of the research group.

I chose a phenomenological approach for the other two studies to best capture the way people perceive of the nearby coal mine and of the many sentient and insentient beings around them. These two themes arose during interviews and coding, and as such I did not have the time to investigate them as thoroughly as the first theme. Cresswell and Poth (2018, p. 75) define a

phenomenological study as one that "describes the common meaning for several individuals of their lived experiences of a concept or a phenomenon." As I did have the opportunity to ask several different people about the mine, a phenomenological approach seemed the best way to make use of the one or two questions I was able to ask about these topics.

While this piece did not have the capacity to be based in participatory action research (PAR), I hope that it could eventually be useful in informing PAR in Sary Mogol. I defer to Yoland Wadsworth for a definition of PAR:

> "Essentially Participatory Action Research (PAR) is research which involves all relevant parties in actively examining together current action (which they experience as problematic) in order to change and improve it. They do this by critically reflecting on the historical, political, cultural, economic, geographic and other contexts which make sense of it…Participatory action research is not just research which is hoped will be followed by action. It is action which is researched, changed and re-researched, with the research process by participants. Nor is it simply an exotic variant of consultation. Instead, it aims to be active co-research, by and for those to be helped. Nor can it be used by one group of people to get another group of people to do what is thought best for them – whether that is to implement a central policy or an organizational or service change. Instead it tries to be a genuinely democratic or non-coercive process whereby those to be helped determine the purposes and outcomes of their own inquiry." Wadsworth 1998, p. 12)

While this thesis does try to engage "relevant parties", and it does begin a "critical reflection of the historical, political, cultural, economic, geographic and other contexts", it falls short in "actively examining together current action." And while Wadsworth proposes a type of research that continues long past any sort of due date, this project has financial and logistical limitations that will bring it to an end: my time working with the people of Sary Mogol is already over. Hopefully, however, research such as this will provide the impetus for future work that fully engages PAR.

FINDINGS

I ask two questions:

1. What are the critical components of an ecological calendar in Sary Mogol?
2. What role can an ecological calendar have in climate change adaptation in Sary Mogol?

An Ecological Calendar of Sary Mogol

The following ecological calendar describes the year in Sary Mogol and is fundamental to the two questions. It mentions all seasonal markers that were mentioned by participants, including those which I draw out as critical components. Beginning with the New Year, it transitions through the seasons, resulting in a story that is neither complete, consensual, nor decisive but which includes a variety of dissenting voices and raises many questions. However, as Kassam et al (2011) observe, ecological calendars are context specific and as a result vary widely even within the same cultural group. Because of this, it is possible and even likely that ecological calendars can vary along a transect with a slight gradient in slope, temperature, aspect, substrate, hydrology, or vegetation. This calendar does not differentiate between potential

microclimates in Sary Mogol, but this requires further investigation. Because some residents of Sary Mogol are recent immigrants, I avoided including information in the calendar that might be referring to a different region, thus ensuring that most of the conflicting data is relevant to Sary Mogol. After the synthesis of the ecological calendar, I include a table of seasonal markers that occur in the calendar.

The Beginning of the Year and Renewed Activity

"When the day and night become equal, this is when we start the New Year" (2)[2]. Navruz occurs on the spring equinox. For most people in Sary Mogol, this event marks the beginning of the year. Navruz is also the cue for spring activity to begin. Frozen soil melts and the smell of spring appears (1). Then migratory birds arrive. Most people say that *Chandaluch* or White Wagtail arrives first (1, 2, 17, 18). One person mentions that there can be a 10 to 15 day difference in the arrival of *Chandaluch* between different years (17). Then *Paktik* (Eurasian Collared Dove) (1, 18), *Ala Partang* (Northern Shoveler), *Angyr* (Ruddy Shelduck), Red-billed Chough (2), *Tourna* (waterfowl spp.) (18), Common Cuckoo, *Bai Ulu* (Little Owl), *Saskabub* (Eurasian Hoopoe), *Kaldugach* (swift spp.), *Julu* (vulture spp.) (4), *Kabutdar* (Hill Pigeon), *Jutchimchik* (lark spp.) all arrive (19). Many people mention *Karachirchik*, a small black bird that arrives in flocks. However, there are different stories about the behavior of *Karachirchik.* One person says that it remains in the community for ten days, before moving on (2), while another says that it leaves when the weather becomes cold (18). Someone else says that the first group of *Karachirchik* to arrive in Sary Mogol dies from the cold (12). Another mentions a bird

[2] Numbers within parentheses refer to the interview number.

that sounds similar and may be the same species: *Khashkaldak* is a black bird with a white stripe on its head, many of which die in spring as they pass through on migration (16).

When the migratory birds arrive while there is still ice in the village, then there will be an early arrival of spring (1). Sometimes the birds arrive but an unexpected frost causes them to die (7). One person says that activity depends on the arrival of the birds: they claimed that this year spring came in May, which was late, and ensured a late arrival of the birds as well (2). After the birds arrive, plants and flowers begin awakening and putting out new growth (1). *Baichechkay* (a white flower), *Otkulok,* and *Kyzgylduk* are all flowers that appear (1, 5, 16). *Kyzgylduk* is present for 10 to 15 days before the red flower dies.

For individuals who bred their sheep and goats in the fall, lambing and kidding will occur between March and May (2, 14). Horses and cows also give birth during this time. One pastoralist gathers twenty female horses from across Sary Mogol and finds one male to breed them with on May 25th (9, 12).

The critical sign of spring however, and the one that allows people to plow and plant, and presumably for perennials to put out new growth, is *jirge top kirge.* This phenomenon is heat coming from the land in the form of steam (1, 17, 20). One person mentioned *jirge top kirge* as the entire process of steam coming from the soil, disappearing, and then the soil becoming dry (2). This is after the birds come. After this, plowing may begin. Another speaks of the surface of the fields being muddy and then becoming dry, allowing for planting (12). One person says that mid-April is when the ground begins to dry (5). In conjunction with this occurs *gur garulde,* when the surface of the earth cracks as the soil begins to thaw, and *kokchikte,* the appearance of new growth (1, 2). The days become longer and warmer, snow melts, and *gur* is the sound that ice makes as it breaks up in the rivers (7, 19).

Marmots appear at this time as well. There seems to be no consensus around the exact date however. One person cites April 17th as the exact date (2), another April 10th, but as early as March 10th if it is a warm spring (3). Yet another says that marmots come 15 to 20 days before the birds arrive, and that if they return to their burrows after appearing, there will be more rain (12). Another person says that marmots do not appear until May 15th, and that this is also when the snow melts (18). The most comprehensive description of marmots says that they generally appear on March 18th. This person says that in *teskay*, "when we are in shadow and sun-facing", marmots appear later. In *kungai* "when we are in the sun and shadow-facing", marmots arrive earlier. The appearance of marmots signifies heat on the earth's surface, and this is when people begin to plow (15).

Others take note of different indicators to begin plowing and planting. One says to look at the stars and moon to begin planting but does not elaborate (2). People throughout the village plow just a few days apart (16). Someone says to plant barley between the end of April and May 15th, and to then plant potatoes immediately after, but mentions that some people wait longer to plant potatoes as they are more sensitive to the cold (2). Another says to *begin* planting barley from May 15th onward, but notes that each year is different (4). Many people agree that *jirge top kirge* and the dispersal of snow signify that it is time to plant barley (4,5). Another simply says that if there is sun, planting will occur, and that the planting of barley and potatoes is usually synchronous: the husband will plant barley in the fields while the wife plants potatoes near the home (8). Another pastoralist agrees, saying that barley and potatoes are planted simultaneously, as soon as the land has thawed (19). One says that barley and *spotsef* are planted together in mixed fields in May when the ground is dry, and potatoes are planted later (1). *Spotsef* only needs to be replanted every eight years (19).

Possibly the most significant warm weather event for the people of Sary Mogol is the transition to *jaillo,* or summer pasture. One person speaks of the government announcement during the Soviet period that would notify people to move to *jaillo* with their livestock between May 15th and July 10th (2). If livestock had not been moved by this time, they would begin to eat the sprouting barley and potatoes, and the owners would be fined (2). One person describes how currently during planting, one person in the village is hired as a shepherd and grazes all the livestock outside of town for 10 to 15 days to allow planting to proceed uninterrupted before taking their livestock to *jaillo* (9). Some people pay a herder to take their livestock to *jaillo,* while others go themselves (2).

Bar: The Spring Season

After considering this information, when has spring arrived? One person says that the last snowfall, *sary kar* (yellow snow), is a wet and heavy snow that people anticipate. This marks the beginning of spring (5). Another says that after the 40-day *childe*, the days become longer, and this is first sign of spring. Thick ice melts from the eaves of the houses (9). Another echoes this, saying that the *childe* ends and the snow melts, signifying the end of spring (36). Someone else cites the precise time of the fifth *tokol* (collision between the moon and a star) in April as the beginning of spring (4). Another simply says that spring arrives on Navruz, but mentions that *top,* the heat on the surface of the earth can be felt, and that the snow melts (5). In contrast, another says that "after March, spring won't come right away – there will be wet snowfall. Spring is about snow cover leaving the earth's surface. It is difficult to predict. Sometimes the surface of the earth is dark on March 21st, but this year it did not occur until May" (14). Another provides general comments on springtime events: "between March and May, marmots arrive,

and birds arrive. Language comes to the living animals. Livestock begin grazing. These are the signs of spring" (38).

Other people relate spring activities without attaching any significance to their occurrence. Sheep and goats (wild and domestic) start giving birth in the pasture (3, 7, 18). Horses, donkeys, and yaks give birth in April and May (7). Horses become active and excited (9), and the livestock that have been overwintering in town search for new grass coming from under the snow (12). One person says that grass appears in April and this is when grazing begins (20). Another says that the grass covering the earth reaches the length of a *soom*, the distance between the end of the extended index finger to the horizontal thumb (19). In April, on the seventh *tokol*, the Marco Polo sheep become fat with new grass and begin to shed. Domestic sheep and dogs shed as well, and their behavior changes as a result (7). On April 10th, after lambing, human activities begin (20). This includes preparing wool for carpets, housework, house construction, and making clothes (17). Women sell their handicrafts to tourists in May before going to summer pasture (17). Circumcisions occur (1). As one person says, "life begins again" (17). *Jer kup du* and *ot kup du* occur. Respectively, the land (*jer*) and the horse (*ot*) "balloon" or "become full again" (9). But this transition time is also a vulnerable time: it is when people become sick (9), and when all the stored food and supplies from the previous summer are being used up (20). This period occurs in March, April and May, and is known as *uzun sary*, or "long yellow" (20).

The seven-star constellation *Urkur* (likely Pleiades) appears in the east in May (2, 24). Before *Urkur* appears, sick people should be fed *koumiss*, or prescribed "water healing" as these treatments are more effective during this time (4, 17, 13). One person says that *Urkur* can only be seen between May and September, and during this time it moves from the east to the west (2).

Another says that *Urkur* disappears on June 1st during *saratan tudu* (summer giving birth) (4). Yet another person says the constellation appears between the end of June and mid-July (25). Another says that *Urkur* does come from the east, and when it passes another constellation, *Taraza,* the days become shorter or longer (7). Someone else asserts that when *Urkur* appears in the east, *kok* (new plant growth) emerges, and when *Urkur* "is down in the west", it is *saratan* (summer) (8). Another says that *Urkur* comes from the west but agrees that when it appears plant growth also begins (8). Regardless of these differences, *Urkur* is strongly associated with *kok,* or vegetation (2, 8, 13, 14, 20). Not only does *Urkur* coincide with the arrival of and affect the quality of *kok,* but it also coincides with its senescence (14, 20). One pastoralist gives a thorough description of *Urkur* in relation to other springtime events:

> "When winter is ending, around lunchtime, there will be water melting from the houses. For 30 minutes to an hour the sun will appear and melt ice from the roofs. There will be a feeling of warmth. Every day during this time the weather will be changing. During the winter, over the period of *childe, Urkur* will already be near the horizon. All of the living things will begin to appear: insects under the carpet, flowers…During all of April and May, I don't see *Urkur* because it is already below the horizon. After *Urkur* sets in April, the frozen ground thaws, *kok* arrives, and spring begins. On June 25th, I start to see *Urkur* again in the east. In the pastures a white flower, *Akbashgudu,* appears when *Urkur* arrives in the east. Drinking *koumiss* for medicinal purposes is only beneficial during this period before *Urkur* arrives in the summer. For anyone with any problem, even cancer, this is healing.

After *Urkur* arrives, *koumiss* loses its healing potential. As *Urkur* goes higher, we approach the fall season and the *kyrgyek* period" (31).

Perhaps because *Urkur* is correlated with pasture, which is the livelihood of the people, it has taken on a magnified importance. When asked about the events in the *Kyrgyz aye,* one person begins with *Urkur,* and only after mentioned different Muslim holidays (25). *Urkur* is so important that people who claim to have no knowledge of celestial events can at least share some information about this constellation. For example, one pastoralist says, "We only care about *Urkur* and when it appears in the spring [and not other signs of spring], because it is good for your health to drink *koumiss* before it appears" (17). Another pastoralist says, "My father used to use celestial events, but I don't know much about it. He would determine the year's upcoming seasonal events by looking at the stars, but I don't know that much. As soon as *Urkur* is rising, the plants also grow. By the time *Urkur* sets, the plants have died" (14).

Jas: The Summer Season

The summer is marked most notably by a period called *saratan,* which is the hottest time of the year (7, 12, 20). Other occurrences include the flowering of potato, harvesting hay, longer days, and the pastures becoming fuller with grass (9). The distinction between spring and summer however, seems to have very little importance. For example, when asked about the beginning of spring, a hunter said: "We predict the timing of summer based on the mating of the ibex and the Marco Polo: if they start breeding early, then we know that spring will be earlier" (10). He uses the words "spring" and "summer" interchangeably. Another person mentions marmots appearing beginning in March when asked about signs of summer, again implying that

the distinction between spring and summer is insignificant, perhaps because the coming of summer does not require major changes in activity (14). These may be attributed to translation errors, but even then, this speaks if nothing else to the conception of spring and summer of Kaziev, a local. The insignificance of distinction occurs in another interview when a pastoralist says, "We know that summer has arrived when the days become longer, and because of the Russian calendar" (16). Another individual lists events such as bird eggs hatching, butterflies appearing, frogs vocalizing and fish spawning, none of which seem to be indicative of any other processes (12). When one pastoralist was asked about signs of summer beginning, he simply said, "The time spent in *jaillo* (summer pasture) is the hottest time of the year" (13). Another pastoralist says "When *chukuru* (a member of the plant family Polygonaceae) is fully grown, it is summer", but in a sense dismisses the importance of this by saying, "the whole summer will pass quickly with milking" without talking about any other livelihood or environmental changes that occur in summer (17).

Activities in *jaillo* include shearing and making *kurak* (felted fabric) (19). During the summer, those who are not at *jaillo* might irrigate the barley and potato fields (1, 29), do housekeeping, make jam and other preserved food, do construction and house repairs (29), or go to the city to rest (19). *Spotsef* is also harvested for the first time around July 15th (5).

Kus: The Autumn Season

Barley is harvested first, then the second harvest of wild fodder and *spotsef*, and finally potatoes, all between August and September (4, 31, 39). When the flower drops from the potato plant, they are ready to harvest (5). Potatoes are best left in the ground later according to some, as they will grow more if it remains warm (9). However, there is a risk of frost damage if left in

the ground too long. One pastoralist spoke of how one year she and her husband waited until October to harvest their potatoes, but most were lost to the frost (24). Another woman tells a cautionary story: "I'm afraid of frost ruining the potatoes so I tend to finish the harvest by the end of September, when the potatoes are not fully grown – the skin will still be soft. You need a lot of time to harvest potatoes, but my husband works, and I don't have a son to help" (33).

In the fall, Common Cuckoo stops singing, and Common Swift is seen everywhere (1). Migratory birds leave Sary Mogol (5). Plants turn yellow and the wind blows, frost and thin ice appear along the shores of the rivers, and the livestock are fat (8, 29). People begin stockpiling dry manure and coal (9). One hunter seeks out Marco Polo beginning in August, after the lambs are self-sufficient (10). Frogs begin hibernating (29, 31). Marmots begin to hibernate. If they hibernate later in the season, the next spring will be better (5). Snow begins as early as September according to one individual (4), and in November to another (29).

Kyrgyek is the turning point in the weather, signifying that it is time to prepare for winter (4). One pastoralist says, "No one knows when *kyrgyek* will come but it comes for one day. If there are livestock on the street at this time, they will die from the cold. Everything will be covered in frost" (4). Another person says that there can be two *kyrgyek* however: "*Kyrgyek* is the most important weather event for this community. It is a big frost that comes in the fall. My father used to say that *kyrgyek* comes in the summer as well. In the summer it is in the form of heat and can affect the animals: you have to bring them into the shade or they will die…If *kyrgyek* doesn't happen in summer then it will happen in the fall" (5). Another pastoralist confirms this saying that there is one *kyrgyek* on August 15th, and another, harsher *kyrgyek* on September 20th that causes the potatoes to freeze if they are left in the ground and the potato flowers to wilt (12). One pastoralist says that *kyrgyek* may or may not happen, and that he

remembers it once occurring three times during the year, and always took the form of intense cold and had the effect of damaging crops (13). Others connect the weather event of *kyrgyek* with the arrival of a bird of the same name in the barley fields (2). This bird is described as thumb-sized, green, and very active: "never stopping in one place" (possibly the Greenish Warbler) (2, 10, 31). When *Kyrgyek* arrives, the cold comes with it, and the potato flowers wilt (2). The bird does not necessarily alert people to the event of *kyrgyek* however. One pastoralist says, "The bird and the cold arrive together, but we notice the bird when the frost happens. We see the bird, and we see how plant life starts dying, and this is how we know that *kyrgyek* has arrived" (31). One person from the Eastern Pamirs says that there, *Kyrgyek* arrives in mid-August, earlier than in Sary Mogol, and that the streams suddenly freeze at this time (10). This person also claims that the concept of *kyrgyek* originates in the Eastern Pamirs (10). One pastoralist says that people begin waiting for *kyrgyek* on August 15th, but that its arrival date changes each year (15), while another says that it seems that *kyrgyek* happens for two to three days at the same time each year (16). According to one pastoralist, the August *kyrgyek* is only the arrival of cold, not the bird (33). One person recalls a *kyrgyek* that occurred four or five years ago. This *kyrgyek* arrived early and brought two days of snow, destroying many potatoes. This person describes *kyrgyek* as a heavy snow that melts quickly and then freezes into the soil (28). Yet another pastoralist says that *Kyrgyek* arrives after September 15th, with a difference of up to five days from year to year (20). One pastoralist encapsulates the significance of *Kyrgyek* in the following passage: "We don't often pay attention to birds: they come and go. This small bird called *Kyrgyek* arrives and brings the cold. When it arrives, all the birds leave. It comes from other countries, touches this land and goes away. This is where the cold wind and frost come from" (16). To some, *Kyrgyek* signifies that it is time to harvest (24).

The town authorities decide on a date by which people are allowed to bring their livestock back from *jaillo,* however, if the first snow arrives before this date, the people will return early (33). The more affluent pastoralists who have a ranch in the pastures remain there with their livestock during the winter (31, 33). Other common reasons given for returning from *jaillo* are *otkachat* (grasses lose their nutritional value and animals are searching for food), sudden cold weather or *kyrgyek,* the beginning of the school season (1), and marmots returning to hibernation between September and August (4, 9).

One pastoralist describes how animal behavior changes in the fall, and the significance of these changes:

> "In the fall, if you release your livestock they will escape to town because of the cold. They know when they have to return. Horses and cows won't let you milk them, and the production of milk declines. *Karkuraturna* (migratory birds) will leave. If they leave earlier, we predict that the winter will come earlier. If they fly high, it will be cold, and if they fly low it will be warm. We all care about the elevation they fly at because it means something. If the marmots hibernate earlier, winter will be coming soon. If the marmots hibernate late, we say that winter won't be so difficult. These events happen almost simultaneously, perhaps within a week of each other" (17).

Most livestock are bred in October to ensure a spring birthing period (12). But for some, winter brings lambs and kids in November and December if they bred their livestock in *jaillo* (19, 21).

Yaks anticipate the spring weather and mate based on when the spring will be warm (5, 32). People know that if the yaks mate early, there will be an early spring, and if they don't mate until November the winter will be harsh (5). One pastoralist says regarding the timing of mating: "Yaks know everything, and never make a mistake. The Marco Polo also never make a mistake" (12). One pastoralist also says that horses manage their mating in the same way as the yaks (14).

Tokchuluk is a period of abundance, feasting, and ceremony that occurs between September and December (5). Weddings, circumcisions, hair-braiding ceremonies for young girls, the blessing of new babies and concerts occur (2, 5, 6, 22). As one person says, "celebrations are all about slaughtering a sheep and sharing it with the people who are important to you" (5).

Kush: The Winter Season

We care about tokson childe and kyrk childe. We count the childe and wait for spring (13). *Childe* signifies the beginning of the winter period for many people. One pastoralist says that when one's spit freezes before hitting the ground, *childe* is coming (39). The first new moon of December brings *tokson childe,* the 90-day *childe,* which occurs over the period of three new moons. Within the *tokson childe* there is a period of 40 days called the *kyrk childe.* These are the coldest days of the year (1, 2, 6). One person says that *tokson childe* arrives on December 20th (5). Another says that the sky is clear and blue during *kyrk childe,* aside from events called *ayarase* when weather anomalies occur (12). One pastoralist says that *kyrk childe* ends on February 20th, while another says that *tokson childe* ends on March 10th (15). All marriages must occur before *childe* because when there is snow it is difficult for relatives to travel (15). During

kyrk childe, no one goes out, and time is spent inside burning coal (17). One pastoralist says that *kyrk childe* begins on December 22nd and can extend ten more days (20).

Throughout the year *tokol* occur and bring weather anomalies or "crazy weather" (1, 24, 31). *Tokol* are when the moon collides with a yellow star (2). When the moon appears during *tokol*, if it is hanging low as a "U" there will be wind and rain, but if it appears as a "C" there will be good weather (3). One *tokol* occurs each month and is named after the day it occurs on (7, 31). However, one person says that it is named after the date in the Gregorian calendar that it occurs on, for example: the December *tokol* occurs on December 11th, and is called the eleventh *tokol* (7). Another person says that the *tokol* is named after the days in relation to the new moon: the eleventh *tokol* is the *tokol* that occurs on the eleventh day of the new moon (31). Some people only recognize *tokol* as occurring during part of the year, in winter (10).

According to one hunter, at the beginning of *tokson childe* on December 15th *kulja borak*, or the mating period of Marco Polo sheep occurs. He describes how the male sheep stand at the peaks of mountains and wait for the weather to change. They stand in place and urinate until the column of frozen urine reaches their stomachs. Then they are ready to mate. The ibex also participates in this ritual, but it is called *teke borak* and occurs ten days after the Marco Polo. Both the ibex and the Marco Polo have a mating period of five to ten days at the beginning of the *childe* (2). If the ibex and Marco Polo begin breeding early, the people know that spring will arrive earlier, but if they breed later and only ten out of one hundred mate, there will be a *jut* (intense snowstorm) (10). Another hunter says that the ibex and Marco Polo mate between late November and early December. He claims that the Marco Polo count the days to when they will give birth (10). December, when there is snow, is also the time to go hunting for one individual. As he says, "The Marco Polo don't let you hunt them when they're mating and giving birth" (2).

Winter is a period of rest for most. Activities of one family include watching television, feeding the livestock, working at a school, and working in the mine (24). People begin burning coal in their homes (31). Men put aside their *kalpak* (traditional tall felt hat) and change clothes (31). Livestock are sheltered inside (35). And again, people wait for the coming of Navruz, the migratory birds, the emergence of marmots, and the thawing of the soil.

Seasonal Marker	**Activity that Occurs**
The spring equinox, or Navruz	Spring activity begins
Marmots emerge from hibernation	*Top,* or heat comes from the land as steam
Top, or heat comes from the land as steam	Plowing and planting begins
Marmots return to their burrows after emerging from hibernation	There will be more spring rain
Plowing and planting begins	Livestock are taken to pasture
Urkur appears	New vegetation appears
Barley grains become full and yellow	Barley is harvested
Flower drops from potato plants	Potatoes are harvested
The weather event *kyrgyek* occurs and the bird *Kyrgyek* arrives	Winter preparations are made
Grasses lose their nutritional value, snow arrives, school begins, marmots hibernate	Livestock are brought back from summer pasture
Migratory birds leave, marmots hibernate	Winter is coming
Yaks mate early (yaks mate late)	Spring will arrive early (spring will arrive late)
Marmots hibernate early (marmots hibernate late)	Spring will arrive early (spring will arrive late)
Spit freezes before reaching the ground	*Childe* is coming
The first new moon of December arrives	*Tokson childe* begins
Tokol, or the meeting of a star with the moon occurs	Weather anomalies occur
Mating of the Marco Polo sheep ends	Hunting of the Marco Polo sheep begins

Table 1
Seasonal Markers in Sary Mogol and their Corresponding Activity

Critical Components of the Ecological Calendar

The seven seasonal markers described in the Introduction are tools that I used to analyze and describe the ecological calendar. While there are many of these markers, some may have a

particularly significant function within the ecological calendar, leading to the first question: *What are the critical components of an ecological calendar in Sary Mogol?*

While many markers were mentioned, some distinguished themselves as critical components of the ecological calendar and as seasonal predictors. I searched for critical components based on their shared characteristics of being reliable, observable, and practical. Components that are reliable can be used under different circumstances without fail. Components that are observable are used by many different people who agree upon their basic meaning. Components that are practical are important for the wellbeing of the community. I identified three critical components that satisfy these three conditions.

Yak breeding time was the most notable critical component. Nine interviewees specifically mentioned that yaks predict the spring weather of the coming year, fulfilling the observable requirement. The yaks were said to be "never wrong" (5), to "know when to mate" (3,5), and to be "a very unique animal because they know how to predict the weather" (16). One pastoralist summed up the reliability of yak breeding as a seasonal marker saying, "In short, yaks know everything. They never make a mistake" (12). The prediction of the yaks allows pastoralists to anticipate and prepare for a long winter, giving the yaks a practical use within the ecological calendar.

The hibernation and emergence of marmots distinguishes itself as another critical component of the ecological calendar. Thirty interviewees mentioned marmots in relation to the beginning or end of a season, the weather, or agricultural activities. Based on when marmots enter hibernation, people are able to predict the quality of the winter and arrival of spring (32). The emergence of marmots from hibernation in the spring signifies that "there is heat on the surface of the earth" (15), that "the soil is good for planting" (18), and that "spring has arrived"

(3, 25). If marmots appear and then again return to their burrows, pastoralists know that spring will be delayed somewhat longer and allow them to adjust their agricultural activities accordingly (25). The behavior of marmots is practical enough that winter pastoralists call people in town to notify them of what the marmots are doing (25). One individual said that "it is impossible that the marmots would be wrong", implying that this marker is reliable (2).

Twelve interviewees spoke about *top* or heat coming from the earth in relation to the beginning of spring, plowing and planting, or the behavior of livestock. This seasonal marker tells community members that it is time to begin plowing (2, 7, 22), it is time to plant barley (4), that spring has arrived (5, 17), and that it is time to plant potatoes (19), so clearly has practical use to the community. While we did not ask interviewees if *top* was a reliable marker, this is obviously something that has an immediate connection with planting and would always signify planting time. However, *top* cannot predict or be held accountable for changes in the weather after planting occurs.

Other seasonal markers which fulfilled one or two but not all three of the requirements remain a part of the ecological calendar but do not earn the title of "critical components" due to the lack of consensus. *Kyrgyek,* for example, was mentioned by many participants and was related to the harvest, return of livestock from the pasture, and the changing of seasons. However, there was very little consensus on the meaning of *kyrgyek.* Also, because the bird *Kyrgyek* and the weather phenomenon *kyrgyek* seem to appear at the same time, they do not act as a reliable predictor. So while *Kyrgyek* is a significant part of the ecological calendar, it does not act as a reliable or observable predictor.

While eleven interviewees mentioned the constellation *Urkur* in relation to human health, a transition in the seasons, or the emergence and senescence of vegetation, this seasonal marker

had little practicality as a predictor. For example, some interviewees said that in May, *Urkur* appears in the east, and begins moving to the west (2,4,7), and this is also when the grass becomes green (8, 13). *Urkur* may be significant to the community for other reasons as well. In a community that is comprised of immigrants, *Urkur* acts as a commonality. It remains a constant for newcomers in a place where landscape, vegetation, soil composition, and language have all changed. However, because *Urkur* only coincides with vegetative life cycles, rather than predicting them, I do not treat it as a critical component.

Due to their reliability, the three critical components already act as efficient climate change adaptation tools for the people of Sary Mogol. However, other questions should be asked to determine if these markers will continue to be effective. How do yaks predict the weather, or in other words, what triggers yak mating? Is this information accessible to all land-users? Are pastoralists encountering difficulties in using these markers, or is there a possibility of this in the future? Finally, if there are existing tools for climate change adaptation in Sary Mogol, we must ask what type of value an idealized ecological calendar could have in the community.

The Ecological Calendar and Climate Change Adaptation

What role can an ecological calendar have in climate change adaptation in Sary Mogol?

As noted by Kassam et al, Indigenous, and specifically Pamiri people already demonstrate climatic adaptability (Kassam et al 2011, Kassam et al 2018). Similarly, in "Reinterpreting Change in Traditional Ecological Knowledge" (2013), Gómez-Baggethun and Reyes-Garcia emphasize the resiliency of communities due to the adaptability and fluidity of TEK:

> "The fact that a specific unit of knowledge is lost or kept by a society is not as important as whether the society retains the ability to generate, transform, transmit, and apply knowledge. It is the capacity to generate and apply knowledge that enables actions and adjustments in response to current and future changes, and therefore it is the capacity to generate and apply knowledge – and not the knowledge itself – that contributes to increase the resilience of a socio-ecological system. Maintaining the capacity to regenerate TEK over time requires the on-going developing, testing, and updating of knowledge" (p. 646).

While there is variability in the weight of and types of value that residents of Sary Mogol give to this knowledge, it seems that IK, and ecological calendars specifically, are well-suited to the role of an adaptation tool. As previously mentioned, the critical components of the ecological calendar may be best suited to assist in climate change adaptation due to the redundancy of the three criteria they meet. In addition, the ecological calendar of Sary Mogol already acts as an adaptation mechanism for the community: it has given immigrants to Sary Mogol an effective way of learning to live in a new environment. While most immigrants to Sary Mogol have a common language and religion, they come from ecologically different places. All of the residents are at least partially reliant on growing barley and potatoes and raising grazing livestock for subsistence (Sonntag, 2016). This means that not only do immigrants to Sary Mogol need to develop relationships with the people around them, they also need to take the time to develop relationships with the new plants, animals, and weather systems that they encounter.

While newcomers to Sary Mogol may be unfamiliar with their new environment, knowledge sharing allows for more rapid adjustment. When asked how they know it is time to

plant, or to bring their livestock to pasture, many interviewees responded that they do these activities when they see their neighbors doing them. Newcomers also bring their own knowledge to the community, which has the potential to create resiliency. For example, one farmer who was born in the Alai Valley told us about the difference in knowledge between people of Pamir and Alai origins. When asked about celestial events, she responded, "I don't pay attention to these things. There is an us and a them: the Alai people, and there are the Eastern Pamiri people. There is a difference in culture: the Pamiri people tend to give more meaning to things like the stars" (1).

Some newcomers seem to have difficulty fully adjusting to their new place. Their knowledge is seated elsewhere, and they are uncomfortable with trying to apply it to Sary Mogol. One farmer born in Khorog, Tajikistan, voiced this discomfort, saying, "If I was in Tajikistan, I would be happy to tell you how spring arrives, but here I am afraid to say how spring arrives, because then maybe snow would arrive" (26). This same interviewee later said that she watches her neighbors to know when to plant her crops. This highlights the current value of knowledge sharing within an ecological calendar for community resilience.

Limitations of the Ecological Calendar

It is important to note that many interviewees did not find meaning in certain indicators, had complete faith in the current ecological calendar as being adaptable to future change, saw little value in the ecological calendar, or saw it as only having cultural value. However, these opinions may be influenced by knowledge loss that occurred during collectivization, or from a generational loss due to immigration compelled by the need to earn remittances.

While many people told us about the meanings of different phenomena, there was a substantial group of people who seemed to put little value in certain events. Regarding celestial events, over one quarter of the interviewees said that they don't pay attention to, do not know, are not interested in or do not use these signs (1, 15, 16, 19, 20, 23, 26, 27, 28, 29, 34, 35). More generally, others said: "We calculate with the Russian months" (6), "I look at the Russian calendar." (12), "I mostly rely on the Russian calendar" (15), and "I mainly use the Russian calendar, but sometimes I do rely on the moons of the Muslim calendar, as there are some weather anomalies that occur every 5th day of the new moon" (14). Other quotes indicated that signs are very context specific and why they may be used by one person and not another. One pastoralist demonstrated this saying, "They say that yaks are smart and know, but I don't really use them as an indicator. I am not a yak herder, I am mostly a sheep herder, so I don't pay attention" (15).

Other interviewees spoke to the adaptability or possible infallibility of the calendar. One interviewee said: "It repeats itself every year, and always will, although some changes might occur with the weather" (1). Another said: "Marmots go into hibernation in August. It is impossible that they would be wrong, so this calendar does not lie" (2). One pastoralist said that the potato harvest happens at the same time every year. He also had no concern about the calendar perpetuating, saying that "it will continue" (8). Another seemed unconcerned: "I will keep teaching this calendar to my children. It is just a difference of fifteen to twenty days depending on the year" (5).

Some people did have concerns for the perpetuation of the calendar. One pastoralist said that she always tells her children the knowledge from the calendar, because while the television may predict rain, it can't always be trusted (2). Another said, "I tell my children and

grandchildren, but they aren't always interested. I hope it will continue, but it depends on whether the next generation is interested" (7).

All interviewees spoke of some ecological time marker. However, two interviewees explicitly said that they are not interested in the ecological calendar. These two participants were the youngest interviewees and both lived in town and did not participate as directly in subsistence practices. For example, one worked as a storekeeper, and both spent most of their time caring for their young children. When we asked one of these interviewees about irrigation of crops in town, her response was: "my brother-in-law takes care of this."

While the ecological calendar of Sary Mogol may not be useful to certain people like the storekeeper as a climate change adaptation tool, it might be valued by these individuals in other ways. One interviewee ascribed more significance to the calendar as a source of cultural pride, or even as an aspect of cultural duty saying, "We do care about celestial events because we are Kyrgyz. I don't use them but since we are Kyrgyz we have to know" (19). Another interviewee answered similarly, associating value with the ecological calendar but attributing less importance to its role as a major subsistence tool, saying, "Within the last four years we have been looking at meteorological data that people are sending us. We have always looked at the *tokol*, but we also look at the meteorological data every morning. It says, for example, what the windspeed in Osh will be. We have access to this data on the television, everyone has access to it" (20).

Why Does this Research Matter?

While the results of this research have not yet contributed to positive change in Sary Mogol, initial work is requisite to inform research that might affect policy. As communities continue to face the effects of climate change, preliminary research such as this will give insight on how communities currently use ecological calendars as an adaptation tool and how they might

assist these communities in the future. The work might later also have some unforeseen cultural value to the community.

MINING AND SARY MOGOL

The Mine and Ecological Calendars

Mining and ecological calendars in Sary Mogol are tightly linked. Collective farming and its associated systems mostly dissolved along with the Soviet Union, and the community made an explicit return to Islam and individualized agricultural practices. However, along with this came the need for personal resource provisioning to account for what would have been provided by the government. As a result, coal collection became a part of livelihood activities, and consequently, also became integrated into the ecological calendar. Interviewees explicitly mentioned coal collection or burning coal as a part of their livelihood activities associated with different seasons. As Sonntag (2016) describes, all households in Sary Mogol rely on coal for energy. This is a testament to the current role of coal both as a resource and as a part of life in Sary Mogol.

A Multi-scalar Problem

After spending some time asking individuals about livelihood practices, it became apparent that economic challenges were a pressing issue for the people of Sary Mogol. Several interviewees described the economic discrepancies now versus during the Soviet Union. One older woman spoke about the difference between economics now and during Soviet times, saying, “Life was better then; we were hardworking people and there was an abundance of

everything. There was no concern for food. We used to be able to buy household things for 15 *som,* but now you can't even buy the things you need for 15,000 *som.* Today you see, if you find something you sell it, but that money doesn't last for a long time." Another interviewee implied that life was more secure during Soviet times, joking, "Thanks to the Soviet Union, I ate all of the candies and chocolates" (38).

After the collapse of the Soviet Union, locals needed to seek out other resource and income options. The coal mines quickly filled this role and have become a fixture of the community since their inception (Sonntag, 2016). After suspected unsustainable harvests of the sole woody fuel source *teresken* led the USSR to ban its use in the region, coal was imported, until the collapse of the Soviet Union and its associated provisioning structures (Ibid; Zandler, 2016). Shortly afterwards, the two proximal coal mines began operating. One of our interviewees, S.B. emphasized the importance of the mines saying, "We don't have another source of income…My kids work there. It provides job opportunities" (14). A.M. said, "You see, we don't have any other source of energy here, so it is better so that people can cook and have electricity. It is better, because it brings employment to the region" (18). One anonymous interviewee said, "We don't have any other resource activity here except livestock. The coal provides many job opportunities. Our families will have enough coal in our house in the winter to heat the house and cook" (27). And S.A. spelled it out for us, saying, "There are jobs because there is coal. Nobody would be living here if there wasn't coal" (26). Sonntag (2016) supported our findings that Sary Mogol would not exist in its present state without the coal mine, saying that many of his informants said that they would leave Sary Mogol if the mine closed.

However, the economic benefits of the mine come with detrimental health effects, and even negatively impact agricultural productivity. Ten interviewees explicitly mentioned health

problems as a negative effect of the mine. K.T. told us about how the mine has affected him and his family:

> "I used to have a pasture near the coal mine. My two daughters would get totally black because they would be playing in the grass, and the dust would come in the wind from the mine. When there is too much heat in the region, the black smoke goes to the river with the wind and sweeps all over the area. I had to move my pasture down. All of the summer pastures near the mine are becoming bad, it is affecting the grass, grass is not growing as well because of the dust. It is becoming a desert. There is almost no summer pasture near here now, just a few people stay but not many. You have to move far to find good pastures" (20).

M.A. told us: "The gas from the mine affects the air. It affects the health of the human beings here. People have lung diseases because of the coal mine. Over 30 kilometers below here there is a gold mine, and there is gas from there as well" (13). While S.B. talked about the role of the mine as an economic opportunity, he also spoke to its health effects, saying, "Coal has a gas, and people have stomach aches and kidney problems. It feels like some kind of wind comes from the mine below…It affects people in the village as well as people who work in the mine. It is an open pit mine and is five kilometers from here" (14). T.S. confirmed this, saying, "It is affecting the health of the people. There is gas from the mine, as you arrive to the mine you can feel that there is a gas", and added that because of the mine, there is less water available to livestock (15). Others spoke of liver issues and air pollution, which they attributed to the mine.

We met with one elder, B. who has dedicated herself to working for the community, as a school teacher; the head of an NGO; a representative for the World Women's congress, an international organization; and a leader in building an education and health center for the community. B. steered our interview towards health, education, and women's issues in Sary Mogol. She began by speaking to the effects of the mines:

> "Many changes are happening in Sary Mogol. The air is polluted now due to the coal mine. There are four coal mines five kilometers from here. For example, we are having health issues like when women give birth, they are having children with five fingers and so on. And some people have small dots in their heart and have to have operations later. This has never happened before. There are many children born without organs to expel waste…One hundred percent of people in the mine work without masks and with their bare hands, so they all experience this. The lambing period is becoming less productive. Newborn sheep are dying. Back during Soviet times, whoever worked in the coal mine was given subsidies, food, all of these supplies…because of the dust from the mine, there is no fodder. The upper pastures by the coal mine are not productive for livestock anymore. We have to go farther away to find productive pastures. They dump the rocks and the waste above the river, and it's shaping the river as well as affecting water that the livestock drink and the people drink. Many people are dying because of lung diseases due to the coal. It would be nice if my son was here, I could show you the mine and the pollution that comes from it. If you give us gas we will take you to the coal mine.

> You will see the women who work in the dumping. The police don't allow you to go into the mine but outside you will see" (11).

Although I never had the opportunity to visit the mine, I did indeed see. One day I was walking up the river that runs through Sary Mogol just fifteen meters from our homestay and was the source of our bathing water. It was also the main source of drinking and cooking water for most community members. I saw something like black glitter on the riverbank. I knelt down and scooped up a handful of what appeared to be mine tailings.

B., although an energetic and respected force in her community, has limited resources. She told us about her rebuked efforts: "Now we are experiencing a direct effect of the coal mine here. For example, the authorities won't let me create a program to help the people with this problem. I go there to the coal mine and ask for subsidies and health care for people…" It is not for lack of inspiration or commitment that B. cannot mitigate the effects of the mine:

> "We need to build a rehabilitating health complex in Sary Mogol. Showers, everything needs to be here. Proper medicine needs to be here as well. One of the companies sends 10 people every year to Osh for health recoveries. All of the drivers are given this opportunity, but not the rest of the people. First we need clean water for Sary Mogol. I've talked to many organizations because the mines dump into our water, and nobody deals with this problem. They have done several projects, but not focused on community health. It's all about building bridges for tourists and building kindergartens. There is no gender equality here…The UN would come and bring flour and wheat for people, but I am the only one who is

> working and promoting everything in this village. All of the NGOs come through me now…We have a lot of problems here. If you are willing to work with us, with development, we would be willing to help and cooperate with you" (11).

In "The Ecology of Time", Kassam et al (2011) outline several effects of climate change observed by people living in the Tajik and Afghan Pamir Mountains. These include: the loss of agricultural land to higher water levels, avalanches and rockslides, and burgeoning glacier-fed lakes. Due to Sary Mogol's advantageous position in a wide valley, we did not hear these complaints from interviewees. The residents of Sary Mogol are more tangibly experiencing the ill effects of the mine and lack of economic opportunities. These are the issues that they are dealing with on a daily basis, and they are the issues that we heard from nearly every interviewee we spoke with. While climate change will have a long-term effect in Sary Mogol, the immediacy of the mine and economic difficulties may prevent people from having the stability and security necessary to manage such a large-scale problem as climate change. Sonntag (2016) makes a clear recommendation for addressing the impact of the mine:

> "Other profiteers of the vulnerability of poor households are the owner and representatives of the coal mine, who can employ the workers to poor working conditions and dismiss them at any time. However, there are hardly any similar paid labour opportunities in Sary-Mogol. Soviet legacies and as a consequence economic and political power asymmetries are reasons for the observed unevenly distributed ownership, wealth and thus also access to energy, natural resources and

construction materials. However, in order to analyse these complex issues it needs further studies, directing the focus on inequality and power relations" (p. 166).

Sonntag (2016) also describes the complexity of vulnerability and interconnectedness of systems within the community: "local people show awareness of the problematic situations and have developed and adapted manifold livelihood activities and coping strategies…They are dealing with vulnerability and especially with energy and resource issues within the realms of their capabilities and possibilities but are often limited due to economic reasons" (p. 166). While Sonntag admits that locals are vulnerable, he recognizes that they are adapting and coping with changes. He also presents the idea that the residents of Sary Mogol are primarily challenged in adaptation due to lack of economic opportunities. This theme occurred again and again during our interviews.

B. spoke of the need for access to alternative economic opportunities, saying, "Now I am teaching women how to make handicrafts and hoping that people want to buy them" (11). We saw the building in which B. was operating this handicraft collective. There was no sign in English outside directing tourists to the handicrafts. Upon entering the building, one had to go through a corridor to access the small room, apparently a school room, as desks had been crowded to one side. There was very little space for the handicrafts, which were primarily woven and felted items. It was clear to us that B. was working with limited resources, and we could only imagine what a functional and beautiful space she could create given better ones.

Diversified Natural Resource Options

In "Poor Kyrgyzstan" (2002), Slaughter outlines three recommendations for economic development in Kyrgyzstan:

> "First, development assistance should not be burdened with equity and poverty reduction agendas. Such objectives tend to undermine the core development focus on basic institutions, defeating both goals in the end. Successful development will both reduce poverty of its own accord and provide revenues for the social safety net. We need to focus on the engine of growth, not its downstream effects. Second, concessional lending in the absence of institutional reform leads to a trap, because the resulting infrastructure provides insufficient growth to pay its cost. The benefits of better infrastructure can only be realized if the economic activity it supports can provide a positive legal return to entrepreneurs. Otherwise, the governments of developing states will be smothered by rising debts that will, in turn, discourage both domestic and foreign investment. Finally, and most important, governmental institutions must be designed to reduce, not increase, the costs of doing business. Regulation must provide transparency, not enable official rent-seeking…If these conditions can be met, many other problems will be easy to solve. If they are not met, no amount of inputs and no number of development entrepreneurs will make much of a difference." (p. 65).

Slaughter elaborates on the potential futility of financial assistance to communities saying: "these efforts are often launched without consideration for what the investment will do to

local entrepreneurial activity, domestic savings, or the potential economic return relative to the subsidy provided" (p. 57). He also claims that energy subsidies don't incentivize resource conservation or innovation, resulting in a disproportionately high energy consumption to income ratio in Kyrgyzstan (Ibid.). This leaves communities vulnerable in unforeseen ways: for example, this phenomenon was observed by Sonntag (2016) when he noted that subsidies of the Soviet Union resulted in construction of large energy-inefficient homes which had significant consequences for families when energy resources become limited. While this argument may seem at odds with my rejection of the rhetoric of progress, I take Slaughter's suggestion as an attempt at addressing the concerns I heard from interviewees: people such as B. expressed frustration with the lack of structure and government accountability and mourned the loss of resources provided by the Soviet Union. Slaughter also argues that the source of Kyrgyz poverty is urban, rather than rural. After the economic collapses of 1993 and 1998, urban Kyrgyz returned home to rural areas, family, and subsistence lifestyles (Ibid.). This emphasizes the importance of bolstering energy resilience in rural communities. While I agree with Slaughter in that local development projects only address the symptoms where resources might be better allocated to the root of the problem, this is often not a realistic expectation. Furthermore, assisting communities to acquire some autonomy may give them a better position from which to address these underlying problems themselves.

While the prominence of secular charities and Islamic institutions in the region might appear to be a solution, in "Corruption as a Last Resort: Adapting to the Market in Central Asia" (2014), McMann notes that neither are able to fill the vacuum left by the dissolution of the Soviet Union. Sonntag (2016) maps six mosques in Sary Mogol, and we were told of new Islamic educational groups being established, but Kaziev told us with some frustration that these

institutions are funded by foreign fundamentalist groups with the objective of furthering a religious agenda rather than improving the well-being of the people. This is confirmed by McMann (2014). Furthermore, we were told during our time in Sary Mogol that women are not allowed to enter mosques, which means that these are only acting as support to a select portion of the population. While McMann writes that mosques, in contrast with Islamic educational institutions, are concerned with both provision of material and spiritual assistance, she also points out that the national government restricts funding to mosques and that local or individual funding for mosques is limited. McMann notes that in 2011 more than 9,851 NGOs were registered in Kyrgyzstan, but that most charities are started by groups with little experience or resources, and that market reform without market-enhancing institutions further inhibits these programs from being effective.

In addition to Sonntag, a paper from Förster et al (2011) gives insight on the resource issue in Sary Mogol. They investigate energy use in five Alai-Pamir communities, one of which is a mere 15 kilometers away from Sary Mogol. They recognize several natural resources challenges for Alai-Pamir communities: poverty and land degradation are highly correlated with energy; the climate of high mountain regions inhibits biomass production yet increases energy requirements for communities; individuals demonstrate little awareness of energy solutions; and that the energy situation varies widely between communities. In this case, Slaughter's solution would at least address the issue of energy disparities between communities. As both Förster and Sonntag note, energy awareness could be useful, however, positive effects might still be inhibited by a lack of resources amongst community members. For example, solutions such as insulation, more efficient stoves, and double pane windows all require individual financial input, which might not be an option for some families.

Zandler et al (2016) address the potential to be found in renewable resources such as photovoltaic (PV) energy in the Pamirs. They present it as an alternative to the present use of *teresken* and hydropower in the Pamirs. They note that hydropower has limits in the arid region, and that relieving pressure from *teresken* could lead to improved pasture and thus increased agricultural productivity, resulting in positive economic impact to communities. As Zandler et al specifically investigated the potential of Murghab, Tajikistan and the surrounding region within a 20-km quadrat, they cited the expense and difficulty of importing coal to this more remote location as an impetus for PV energy solutions. However, while coal is easily accessible to the people of Sary Mogol, it has other costs to the community, making PV energy a compelling potential alternative. Yet, as Kassam pointed out to me in conversation, PV energy may not have the same economic potential for the community that coal does, and as we found during interviews, coal equals jobs in Sary Mogol.

Taking into account Zandler et al (2016) and Förster et al (2011), the following should be considered in future research investigating natural resource use in the Pamir-Alai region: 1) increasing energy awareness; 2) improving access to renewable resources; and 3) poverty and natural resources issues must be addressed jointly. I add one consideration to this list: coal means autonomy in Sary Mogol. For some, it may be a welcome tactic towards self-sufficiency, while for others it might just be a necessary livelihood activity. More specifically, the presence of the mine may be attached to emotions related to individuality and autonomy. Favoring alternative options over the mine, such as subsidized PV energy, may have unexpected side effects. For example, how might removing access to coal and substituting this with government services evoke memories of instability after the dissolution of the Soviet Union? Changes in natural resource use and regulation in the Pamir-Alai region must be made with thoughtful consideration

of the historical, cultural and physical contexts. Based on Slaughter (2002) and our interviewees, policy changes are needed. Again, these must be developed from an understanding of the multiple contexts. It seems that a return to some Soviet practices, for example, could be a welcome change in Sary Mogol. And while it seems that new natural resource and environmental protection policy needs to be enacted, I concede to Slaughter's argument that large-scale governmental reform is necessary before small-scale action can be fully effective.

RECOMMENDATIONS FOR FUTURE RESEARCH

As this thesis has addressed a multiplicity of phenomena in Sary Mogol, it has elicited many questions without necessarily engaging each fully, and there are many that require further research. I suggest investigating the following threads in future inquiry:

1. What is the biological basis for each indicator? Some relevant questions would be: What triggers yak mating? What triggers marmot hibernation? And the chicken or the egg question: does *Kyrgyek* migrate before frost arrives, after, or is this behavior independent of frost? Addressing these questions would help to determine the true reliability of indicators. If it seems that these indicators might be variable with climate change, other indicators will need to be investigated and climatic data may need to take on a more leading role in climate change adaptation.

2. As described in the *Limitations* section, a principle components analysis might be useful in gauging how people with different livelihood activities have different uses for an ecological calendar. Such an analysis could assist in further specializing the calendar for

different groups. For example, a survey could be used for investigating differences between age, gender, occupation, and ethnicity/origins.

3. This thesis described the complex relationship between the people and land of Sary Mogol with the coal mine. However, further investigation could pull out intricacies of issues involving the coal mine. Who has access and how? Who is most negatively affected by the mine? Are there sustainable alternatives that would continue to support the community economically while relieving dependence on the mine? And perhaps most importantly, what would be the consequences if the community was to lose access to the mine?

In summary, there is potential for future research addressing biological factors in ecological calendars, the use and usability of ecological calendars, and natural resource use in Sary Mogol. The range of these recommendations is testament to the need for extensive research in various disciplines. This applies not only to Sary Mogol, to the Pamir region, or to Central Asia, but wherever people are experiencing vulnerability due to climate change being compounded by other factors.

GLOSSARY

akbashgudu
a white flower of the pastures (species unknown)

aksakal
the white beard system, or court of elders

Ala Partang
Northern Shoveler *(Spatula clypeata)*

Angyr
Ruddy Shelduck *(Tadorna ferruginea)*

aye
moon, month

baichechkay
a white flower, likely *Asteraceae* (species unknown)

Bai Ulu
Little Owl *(Athene noctua)*

bar
spring season

Chandaluch
White Wagtail *(Motacilla alba)*

childe
a period of cold weather in the winter

chilla
interim periods within the calendar of the human body

chukuru
a member of the plant family *Polygynaceae* (species unknown)

gur
cracking; the sound that the ice in the river makes as it is breaking up

gur garulde
the cracking of the soil as it begins to thaw

hisobdon
a Persian time-keeper associated with the calendar of the human body

jaillo
summer pasture

jas
summer season

jer kup du
the land balloons or becomes full again

jirge top kirge
heat coming from the land in the form of steam

Julu
vulture (species unknown)

jut
a blizzard that has the potential to devastate livestock holdings

Jutchimchik
lark (species unknown)

Kabutdar

Hill Pigeon *(Columba rupestris)*

Kaldugach
swift (species unknown)

kalpak
the tall felt hat of the Kyrgyz

Karachirchik
a small black migratory bird (species unknown)

karkuraturna
birds that are migratory

Khashkaldak
small black migratory bird with white stripe on head (species unknown)

kolkhoz (kollektivnoe chozjajstvo)
Soviet collective farms

kok
vegetation

kokchikte
the appearance of vegetation in the spring

koumiss
fermented milk beverage

kulja borak
the mating period of Marco Polo sheep *(Ovis ammon polii)*

kunbala tashtade
the miscarriage of the sun, or the transition from summer to fall

kungai
the period of being in the sun and shadow-facing

kurak
felted fabric

kus
autumn season

kush
winter season

Kyrgyek
a small active warbler that is associated with the climate event kyrgyek (possibly the Greenish Warbler *(Phylloscopus trochiloides)*)

kyrgyek
a sudden frost in the fall

kyrgyzchylyk
Kyrgyzness

kyrk childe
a period of 40 days that occurs within *tokson childe* and is the coldest time of the year

kyzgylduk
a spring ephemeral with a red inflorescence (species unknown)

Navruz
the Persian New Year, occurring around March 21st

oblast
province

otkachat
: the quality of vegetation in the fall when it has lost its nutritional quality

otkulok
: a flower (species unknown)

ot kup du
: the horse balloons or becomes full again (in the spring)

Paktik
: Eurasian Collared Dove *(Streptopelia decaocto)*

saratan
: the warmest period of summer

saratan tudu
: summer giving birth, or the peak of summer

sary kar
: yellow snow, the wet and heavy snow towards the beginning of spring

Saskabub
: Eurasian Hoopoe *(Upupa epops)*

som
: the currency of Kyrgyzstan

soom
: the distance between the end of the extended index finger to the horizontal thumb

spotsef
: a member of the plant family *Fabaceae,* used as fodder (species unknown)

Taraza
: a constellation that interacts with Urkur

teke borak
: the mating period of ibex *(Capra sibirica)*

teresken
: a shrub burned for energy *(Krascheninnikovia ceratoides)*

teskay
: the period of being in shadow and sun-facing

tokchuluk
: the period of abundance occurring in the late fall

tokol
: the meeting of the moon with a yellow star, which brings weather anomalies

tokson childe
: a period of 90 days which occurs over the period of three new moons in the winter.

top
: heat coming from the surface of the earth

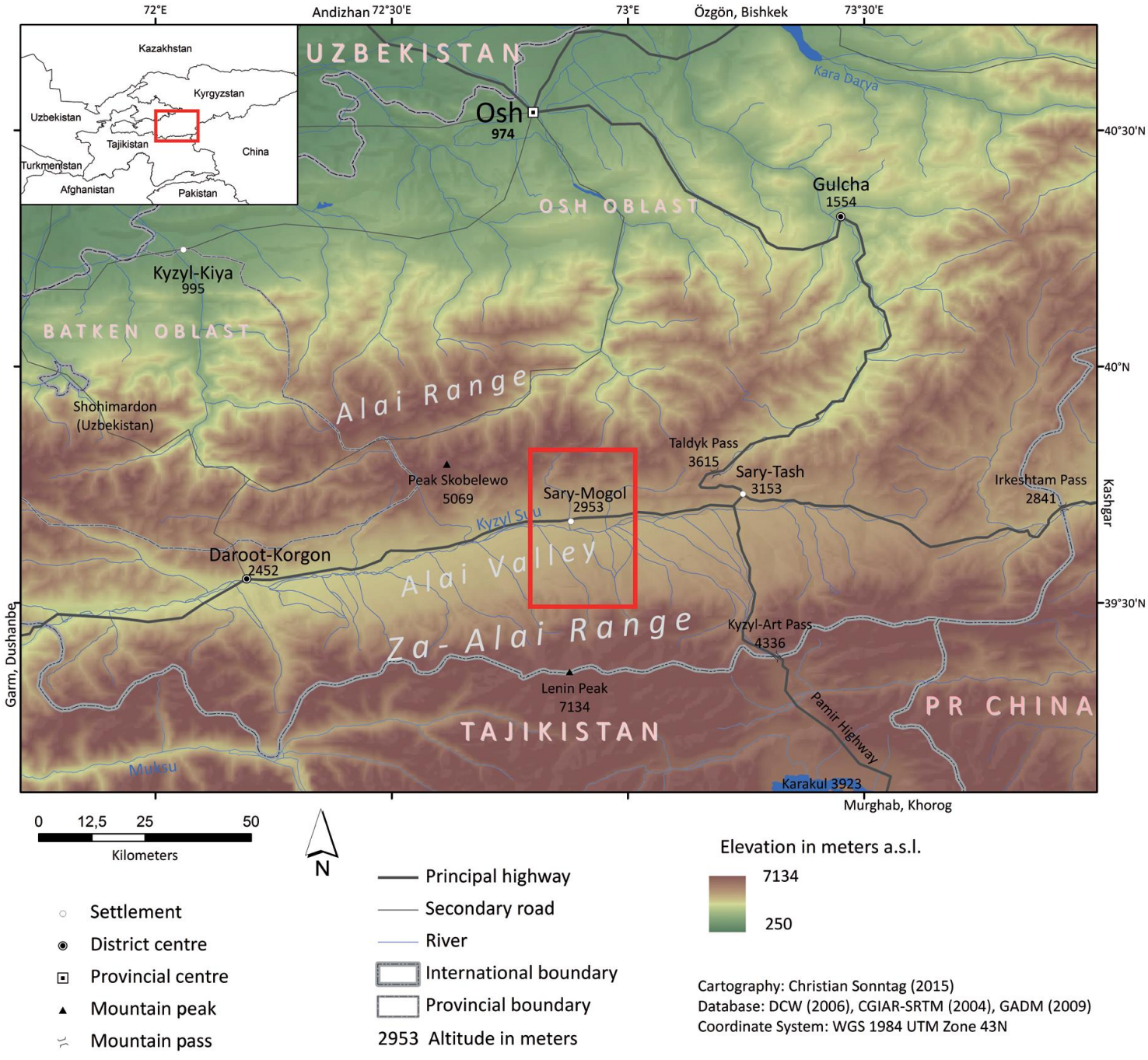
tourna
: waterfowl

uchuk
: a healing ritual

Urkur
: a constellation of seven stars, likely Pleiades

uzun sary
: “long yellow”, a period when supplies are dwindling at the end of winter

APPENDIX



Map 1: Location of the research area in the Alai Valley in Southern Kyrgyzstan (Sonntag, 2016)

Sary Mogol Interview Participants
July 2017

Interview #	Background	Year of Birth	Gender
1	Pastoralist	1950	F
2	Tractor Driver/ Pastoralist/Hunter	~1965	M
3	Storage Manager/Pastoralist	1947	M
4	Pastoralist	1948	F
5	Cleaner/Pastoralist	1952	F
6	Pastoralist	1941	F
7	Pastoralist	~1950	M
8	Pastoralist	1972	M
9	Veterinarian	~1960	M
10	Hunting Guide	1949	M
11	History Teacher/Leader of an NGO	1951	F
12	Tractor Driver/Herder/Pastoralist	1957	M
13	Guard/Pastoralist	1957	M
14	Driver/Pastoralist/Veterinarian/Miner	1957	M
15	Pastoralist	1963	M
16	Secretary/Pastoralist	1957	F
17	Pastoralist/Housewife	1969	F
18	English Teacher/Pastoralist	1946	F
19	Pastoralist/Housewife	1965	F
20	Driver/Pastoralist	1951	M
21	Pastoralist	1972	F
22	Storekeeper/Housewife	1993	F
23	Housewife	1991	F
24	Pastoralist	1947	M
25	Ethics Teacher/Pastoralist	1949	M
26	Dairy Hand/Pastoralist	1970	F
27	Cultural Events Coordinator/ Pastoralist	~1975	F
28	Pastoralist	~1955	F
29	Miner/Prospector/Pastoralist	1982	M
30	Nurse/Pastoralist	1968	F
31	Truck Driver/Mechanic/Pastoralist	1959	M
32	Dairy Hand/Pastoralist	1961	F
33	Teacher/Pastoralist	1975	F
34	Pastoralist/Housewife	1974	F
35	Truck Driver/Pastoralist/Village Head	1962	M
36	Pastoralist/Hunting Guide	1946	M
37	Pastoralist	1965	F
38	Pastoralist	1943	M
39	Pastoralist	1985	M

Participants Invited to Sary Mogol Group Workshop
July 2, 2016

#	Background	Year of Birth
1	Transporter/ Land User	1950
2	Pastoralist/Land User	1944
3	Transporter/ Pastoralist	1949
4	Doctor	1951
5	Dentist	1958
6	Sociologist	1961
7	Hay Transporter	1944
8	Hay Transporter	1955
9	Truck Driver	1964
10	Transporter/ Land User	1968
11	Teacher	1941
12	Soviet Salesman	1952
13	Transporter/ Land User	1948
14	Road Worker	1937
15	Hay Transporter	1959
16	Veterinarian	1952
17	Teacher/ Pastoralist	1944
18	Transporter/ Teacher	1941
19	Soviet Land Manager	1959
21	Hay Transporter	1951
22	Hay Transporter	1949
23	Pastoralist	1938
24	Pastoralist	1960
25	Pastoralist	1950
26	Biology Teacher	1955
27	Hay Transporter	1956
28	Land User	1959
29	Land User	1972
30	Teacher	1945
31	Son of Hunter/Hunter	1979
32	Teacher	1944
33	Pastoralist/Land User	1960
34	Unknown	Unknown

Notes from Workshop in Sary Mogol
July 13, 2016

Karim welcomes the participants, who announce their happiness for being invited. Then Karim greets the participants in Arabic and gives an explanation of the purposes/objectives of the meeting. He explains the reasons for coming to Sary Mogol, that is to understand Climate Change (CC), the way climate is connected to and affects their livelihoods.

Karim explains that other parts of Pamirs are getting warmer, and it has been noticed that lands in the summer pasture are getting drier and that is becoming harder to grow certain kinds of fruits. Participants confirm these last statements with facial and vocal expressions. Furthermore, Karim indicates that in certain parts of Pamirs is easier to grow wheat and barley.

Then Karim indicates that the objective of our project is to build anticipatory capacity for the effects of CC on livelihoods, with a purpose to continue this project for long-time and commit for the future with their (villagers) partnership and our student presence.

Karim asks if there any questions.

Participants would like the project team to be introduced

Karim introduces the team:
- Karim-Aly Kassam is a professor in America. Participants want to know from which city;
- Jianchu Xu is a professor from China, where we just worked together last week. Participants want to know where we were working in China, and then later indicated that they were familiar with the region of of Tashkurgan;
- Cyrus Samimi is a professor from Germany, and Antonio Trabucco from Italy;
- Tobias, who has been working here since 2012, is from Germany;
- and the important contributions of the two students Tomas and Daler.

Soon after, Karim gives a presentation on the Ecological Calendars (EC). Below excerpts of the slide presentation are reported.

- Northern communities and mountain societies are facing climate change and unusual climate events.
- Furthermore, climate change has a direct impact on their livelihoods and food systems.
- 70-80% of the food production in the world depends on small farmers, like you.
- People like you are not uncomfortable with change. However the changes that are happening are rapid and frequent and are creating anxiety.
- This is important because you need to plan at least 1 year in advance your activities (acknowledgment from the participants).
- Climate change is occurring in situations where inequalities and degradation of landscape are already present thus, exacerbating the situation.
- In the past 15-20 years there have dramatic climatic events in the mountains of Central Asia. How do we develop anticipatory capacity for these changes?
- Your brothers in other parts of the mountains have planned activities and integrated their livelihoods with the land and stars.
- We are thinking that one way to manage changes is an EC (one participant, a medical doctor, seems to understand the concept of EC, and repeats its name).
- We would like to build a research partnership with you to revitalize EC.
- An EC is, for instance, when a flower buds, migratory birds arrive, an insect appears, or snow melts. These are signals to plant or take animals to pasture or harvest (acknowledgment).

- When a flower appears or opens, for instance on May 1st, we plant seeds and on September we have a crop. With CC it is warmer, and the same flower may appear on April. However, if we wait until May to plant, and we may not get a good crop.
- With EC we don't look at dates, but at ecological indicators such as flowers, and we then have a good harvest.
- We have already made 3 seasonal rounds. This will be the fourth place. The first two are in North America, with people of Indigenous and European descent. The third was made with the Wakhi in China. Today we want to create a fourth seasonal round with you.
- We want to document seasonal activities, for instance: when to plant, when there are hazards such as floods or avalanches, and which signs you use in your environment to guide your livelihood activities.
- After three years we want to: have an EC that people can use; develop knowledge and curricula that children can use in school, so that knowledge stays alive; and build an online platform where people, like you, and around the world can share knowledge.
- There are many places beside ours where people are starting studies on EC, which would be shared in an international conference at the end of this project.

Karim asks if there are any questions

P (Participant) – How did you come up with seasonal rounds? Is it a planetary cycle?

K (Karim) – It is knowledge about existing activities during the different seasons. No, it is the activities within one year and not about the solar system.

P – Where is Karim from (tribe)?

K – I am a Muslim, and I can trace my family 20 generations back, from the Persian Gulf to Zanzibar in East Africa. My grandfather comes from there. In Africa there was political instability, and problems due to the fact that our skin is neither white nor black. The only country with open arms to us was Canada, where my family lives and where it is protected. Ten years ago I moved to Cornell.

P – Is there other life in the universe?

K – Only the creator knows, but we cannot be so arrogant to think that there may not be life in the universe with so many planets. The first verse of the Koran (Sura al-Iqra) reads: "in the name of the creator, that created you from a single cell, and taught you by the pen." Our religion is a religion of knowledge, science, and peace.

P – What about science fiction, like Star Trek?

K – To our knowledge, we don't know. But it is a good question, because I also would like to know.

P – Is it true that in North America alien objects were found?

K – I don't know but there is no evidence. I consider that there are many unknown problems, and also on our planet, there are many problems that should be considered and solved. We need to protect our own planet. (People were asking the questioner to stop so that we could begin.)

Karim suggests we start the seasonal round.

K – How do people in Sary Mogol know when the winter has ended?

P – When *Childe* is over. This is the 40-day period with the coldest days in the year. There are two 25-day periods before and after the childe.

P – Total period of winter is *Tokson Childe* (90-day *childe*) from December 5th to March 5th.

P – Before the start of the *Kyrk childe* (40 days) there are 3 main events:
1- Sun returns, i.e. the nights become shorter and the days longer (after Dec. 21)
2- When male ibex chase the females, i.e. begin mating.
3- When icicles form on the coldest days on the trees and houses.

P - Pastoralists need to mix the dung in the animal coral (fenced animals) to make sure it does not freeze. (They are maintaining the winter shelter of the animals).

P – People get excited when icicles falls from the roof, meaning that winter is ending. This is a sign of the remaining 25 days of the winter *Childe.*

P – Longer periods between five time *Namaz*.

P – In the 25-day period after, until March 5th, snow starts to melt and the days become longer.

P – For pastoralist activities, *jut* (spring snow storm) is a frightening event. If marmots appear before the end of *Tokson Childe,* then there is a high probability of *jut* occurring. In 2010, *jut* came and it was very hard for livestock. In 2015 there was a lot of snow, but no problems.

P - Spring is called *Baar (Jaz)*. If marmots appear in the second half of March (March 18th or 21st), it will be a good, normal, year.

P – *Chandulüch* (White Wagtail) arrives to mark the beginning of spring. Also *Angyr* (Ruddy Shelduck) arrives to mark the beginning of Spring.

P - *Kyzyl Suu* (Red River) opens, while snow melts, which a good sign for spring.

P – Calving season begins in spring. A lot depends on the livestock owner.

P – Offspring season begins after cows start to graze around their shelters, this is a good sign of spring.

P – The word for vegetation is generalized as *kök kubuu* (looking for the blue), which arrives when the snow starts to melt, and livestock would go and graze on it to mark arrival of spring.

K – How many seasons do you have?

P – Four. *Kush* for winter, *Baar* or *Jaz* for spring, *Saratan* for summer and *Küz* for autumn.

P – When *Baar*, or spring, has arrived people can feel the heat from the ground, and plowing can start.

People wanted to talk about land use activities next.

P – At these lower elevations, *pas*, we know to plant barley between April 15th and May 15th, and then potatoes later. *Amal* (period of spring activities) begins later at higher elevations. First we plant barley and then potatoes.

K – What signs do you see to decide when to plant barley?

P – Heat from the ground. It is about *top* (feeling the heat from the ground).

K- How do you know that there is heat from the ground?

P – From the experience of burying people, 50 cm of the land is frozen which creates a challenge to dig a grave, when the spring arrives the land is softer.

K - What are the signs for planting potatoes?

P – To wait until the soil is warmer, after barley has been planted.

P – Today is the warmest of *saratan* we have seen. Otherwise it has been cold.

P – When *Baar* is ending two events occur:

1) Barley is planted and people are very busy with agricultural activities *Amal-aylary* (starting 21st of March,) when the heat is in the air (it is becoming warmer).
2) Burn shrubs to heat houses and keep the children warm. After March 5th, babies will be safe without heating (mid-April to mid-May).

P – There is a period of starvation at this time, called *uzun sary* (long yellow[3]). This is when food products are at their least. You need to secure food for your survival.

P –A constellation of stars *(ürkör)* is used as astronomical indicator, which is visible at a lower elevation in the sky (goes down to the west) to *unar*. At this point *kök* (vegetation) arrives.

P – The mating of horses begins, males are virile, this is also an indicator for the end of *Baar*.

[3] Yellow has a negative connotation. One does not give yellow cloth.

The elders are telling the younger people to keep quiet, since they are talking.

K- How do you know that *Baar* has ended?

P- There are three events marking that indicate the end of *Baar*:

1. At the end of *Baar*, animals are moved to summer pastures. People migrate to the *jaillo* (summer pasture).

   K – Are there two or three types of pastures?

   P – Two types only[4].

2. In this period the sheep and goats are sheared.
3. They are castrated on the summer pasture.

P – 40 days after planting, barley should reach three *acha* (measurement between thumb and middle finger) and requires the first irrigation. Following this, irrigation should occur (three to four times) throughout *Saratan*. Barley becomes darker (it indicates water stress, i.e. less green).

K – How many days are between planting barley and potatoes?

P – Just after few days, the elders say. The young ones state that it is better to plant potatoes 20-30 days after barley to avoid eventual and recurrent snow and frost damage in June. They referred to chilling from humidity.

P – Potatoes are harvested 60 days after they are planted.

K – When is barley harvested?

P – At the beginning of September, and there two indicators for its harvesting:

1) The heads (spikes) of barley become heavy and it bends (lodging).
2) The stems of barley become yellow.

K – What do you use barley for?

P – For animal nutrition.

K – When do you harvest fodder?

P – At the end of August but harvest depends on temperature as well.

P – At the end of summer, people in the summer pasture are doing activities to prepare for winter, like preparing food.

K – Are there festivals in this period, like wedding festivals or during another season?

[4] Summer and winter pastures

P – Fall is the typical period of feast and festivals because the animals are fat and there is food in abundance, *bushukchulyk* (period of plenty).

The participants are washing their hands, getting ready for tea. They talk about astronomical events, but they want to have tea before we proceed. There is a lot of fresh and good bread together with tea. People start to consume sheep. Towards the middle of the meal, Karim engages participants with new questions.

K – Have you noticed signs of climate change?

P – Each year is getting colder. When participants were younger it was not as cold. In the past the snow could easily reach the height of a house. Also the spring was warmer before. Winter and spring were warmer before, but with more snowfall.[5]

K – How was the weather this year?

P – This year, before spring, there was a lot of wind. Also a lot of earthquakes occurred this year. The snow has melted faster this year. Thus, the natural fodders at the pastures this season were less extensive and became yellow (dry). There has been less rain and snowfall, although it is a bit colder than normal, and less green pastures.

P – Two younger participants are suggesting that people nowadays get sick more frequently, especially the young, because of heat. Diseases are spreading from animals to people. A doctor was present and stated that in reality, because of lack of vaccination, people (and animals) get more diseases. (This is more closely related to the collapse of Soviet infrastructure, and not much to do with climate).

P- Starting from 2008 to 2014, potatoes have not grown well, mostly due to co-occurrence of chilly and humid conditions in the growing season (i.e. frost, cloudy and windy conditions with dropping temperatures). This would be recurrent a few times in the summer period, and even snow would come in August sometimes.

Karim asks if at the other end of the room, where elders are, there is enough food. Participants were satisfied and thank Karim.

K – As winter is colder, are summer and fall also colder?

P – While winter is colder, summer is rather unusual and unpredictable.

P – A particular phenomenon is described occurring at the end of winter and beginning of spring, called *kara suuk* or black cold, which is very cold weather without snow. The land is frozen without snow. Nothing is on time, and mostly because of reduced snowfall in the past few years the vegetation is brown. If the winter is warmer, there is more snow, otherwise winter is colder and with less snow. Because of the cold the season of activities comes late.

[5] Kyrgyz elsewhere have mentioned to me that spring is a continuation of winter

P – Strong wind and soil erosion creates a lot of dust, with many problems.

The meat was shared according to a hierarchy of respect, with more respected people (who also spoke the most) having the best choices. We, the interviewers, got the ribs. People are taking most of the food home in bags.

P – Most social events occur in September, October and November, which are the months of feasts such as weddings, when the sheep are the fattest in fall. However, circumcision takes place in both the spring and autumn.

K – Do you celebrate *Navruz*?

P- *Navruz* is on the 21st or 22nd of March.

K - Do you have specific celebrations to commemorate dead people?

P – 40 days and one year after the death.

K – Is there any specific date to celebrate all of them?

P- No

P – *Idd al Fitr (Orozo Ait)* and *Idd Al Qurban (Qurban Ait)* are when we sacrifice animals and recite from the Koran. *Qurban* is 70 days after *Ramadan*.

K – Do you calculate this (days after *Ramadan*), counting the moon?

P – Yes

K – And *Qurban Ait* comes with a new moon?

P – No, just after 70 days.

P – We don't have other festivals, except national holidays.

K –What other signs of activities in the fall?

P – In the fall there is harvest.

K - For harvest what signs do you interpret?

P – When the flower of the potato falls, the harvest of potatoes starts.

P – When the marmots start hibernation it is a clear indicator of fall. In addition, pastures turn yellow.

K – When do birds leave?

P – During September birds will leave and marmots will hibernate independently of snow cover. Day and night are equal on September 21st.

P – There is usually reduction of fresh water and stream flow.

P – The cold weather arrives with the passage from west to east of a bird, *Kurgayek*, who leaves when cold wind arrives. It can sit on a blade of grass (possibly Syke's Warbler or Asian Desert Warbler).

P – When cold weather comes some weak livestock die (mid-September).

P – With the passage of this bird, there is a strong need of terminating several activities, like harvest, but also to return from the summer pasture because it will get cold.

K- What kind of fuel do you use?

P – In October, there are other main activities, including collection of fuel (dung and coal).

P – There is also mating of livestock, but not in summer pastures, at the end of September and beginning of October. After six months livestock give birth to offspring. Most of the work for winter revolves around animal care, and preparation of enough barley, potatoes and fodder to survive the winter.

P - Most of the people stay in the village and feed the livestock and some stay at certain places in the pastures because strong winds keep them snow free.

P – If there is enough livestock, extra animals would be sold in the market in the fall. Depending on climatic conditions in spring and summer, some animals might be sold on the market beforehand.

K- Do you harvest fodder one or two times a year?

P - All the fodder is harvested once a year, in August, September, and October.

K- What is the sign for harvesting fodder?

P- Sign for harvest is when the flowers are gone, and plants are still green and soft.

P – There is a constellation of stars *(ürkör)* which are used as an astronomical seasonal indicator. When these stars come from the west towards the sunrise, then birds will go. When these stars rise in the sky then the cold weather will arrive.

K – Is there a mismatch between the stars and what happens on the land, like birds leaving?

P – Everything is matching. Marmot is a good indicator and is always on time.

P - *Taraza* is when night and day are equal. September, December, and March 21st.

P – People understand changing seasons from astronomical signs, specifically with the constellation moving towards the sunrise and then up or down (clarify).

P- Participants feel they have said everything, but there is still one thing about anomalies, i.e. *tokol*. During the arrival of a new moon there is a weather anomaly (often wind) which is termed as *tokol.*

December there are 11 *tokol*
January there are 9
February there are 7
March there are 5
April there are 3
May there is 1

P- Every new moon produces an anomaly. There is one star that becomes an obstacle to the moon. The moon and stars will get closer, and then the anomaly will happen. When the moon and stars come closer, climate events occur.

P – *Besh tokoldon kiin beshiktegi bala yshyboit* (after the anomalies in March, a child in a cradle will not get cold) – see above.

K – Can you tell us about hazards?

P – Earthquakes are common. No floods. There are avalanches in the spring.

P – After the end of winter, in *Baar*, there may be wet snow falling, which may cause risk of avalanches. This wet snowfall is called *sari kar*, or yellow snow. Horned Lark is not scared of *jut* and remains.

Karim thanks all the participants from the bottom of his heart and announces to people that a new climate station/camera will be located near the school, and another in the pastures. These need to be safe for the good success of the project.

While people thank Karim for the invitation, Karim reminds everyone that we are all the same and made from the same soul. Furthermore, Karim asks for the community to help and protect the students, who will be coming in the next years to Sary Mogol. Participants ask that the students should say the name of Karim and feel safe. Karim shows the seasonal round and explains/reminds that this is their knowledge.

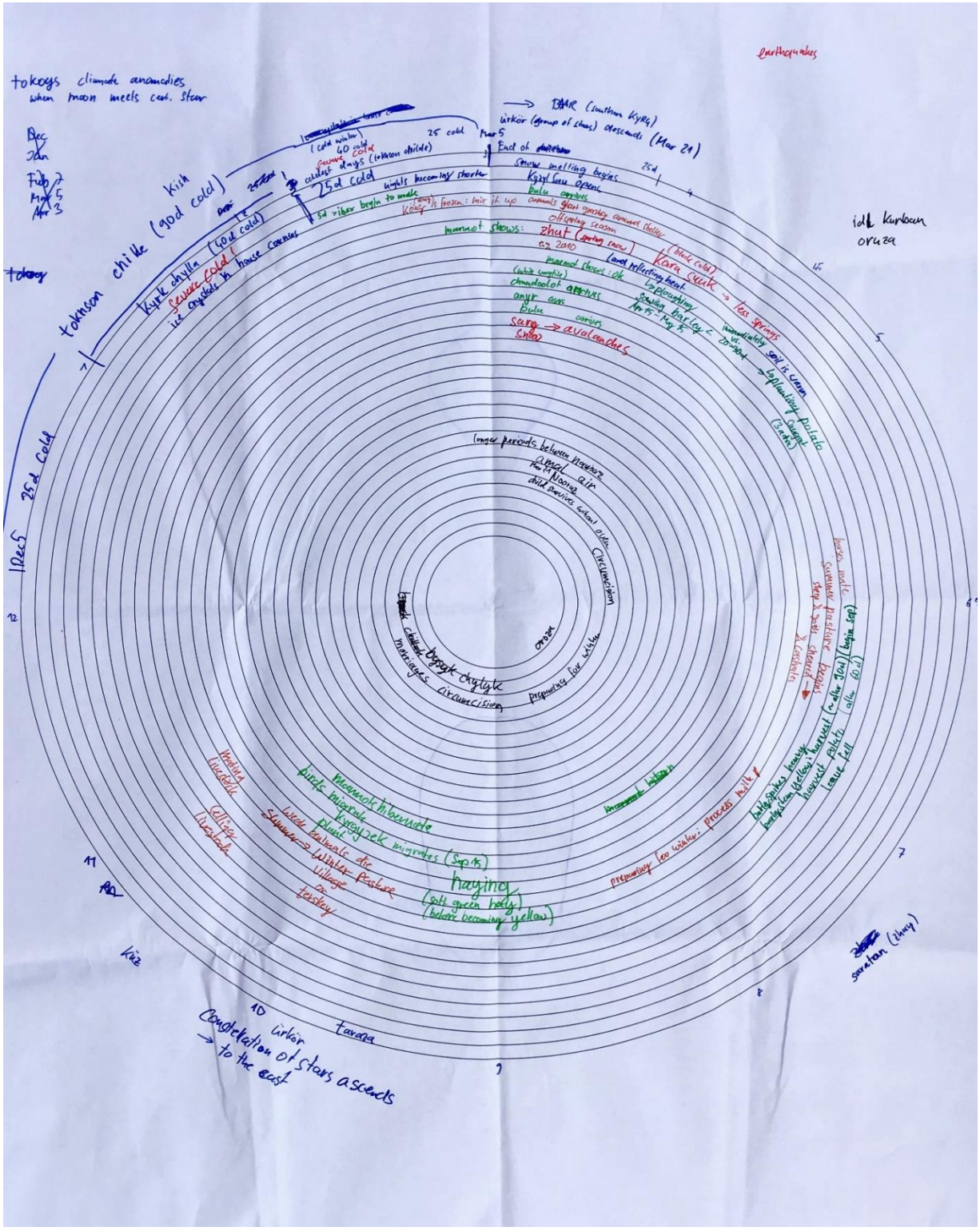


Figure 1
Seasonal Round from the Workshop

In Person Interview Guide for Sary Mogol, Kyrgyzstan

Inclusion criteria: Participants must be 18 years old and residents of communities around Sary Mogol, Kyrgyzstan.
Duration of interview: approximately 90 minutes
Location: In the participant's home or at a community center

1. **Introductions** (5 minutes): Introduce the research team (field research manager and community researcher) and provide a brief overview of the research.
2. **Written informed consent** (10 minutes): Provide a copy of the form 'Written Consent for In Person Interview' and 'Contact Information Sheet' to the participant. Read the form together aloud, stopping to answer any questions. Use the audio recorder to record verbal consent, in addition to the participant's name and age.
3. **Audio recording:** If the participant has signed the section giving permission to record the session with a digital audio recording device, turn it on to begin recording.
4. **Semi-structured interview** (60 minutes): For a semi-structured interview, the order of themes and topics is flexible based on the participant's responses. The following list includes sample questions organized by themes and responses. The questions selected for each interview will focus on those themes and topics to which the participant is most responsive with respect (i.e. sensitivity to diversity of knowledge).

Intro questions

- What is your name/age?
- Where do you live?
- What is your occupation? Where do you work?
- How do you spend your days?

Climate change

- Over the course of your lifetime, has the climate in Sary Mogol changed? How so?
- Has the weather become more or less variable? How so?
- Has the weather become more or less predictable? How so?
- How do you feel about the changes you have described? How have these changes affected you and your community? Have these changes had any negative repercussions? Have these changes opened up any new opportunities?
- Why have these changes been happening?
- How have these changes affected the plants and animals in and around Sary Mogol?
- How do you expect the climate to change in the next 10 and 20 years?
- Have you changed your activities because of climate change? How have you changed?
- Have others changed their activities or behaviors because of climate change?
- How can your community prepare and respond to climate changes?

Seasonal indicators and cues

- Are there signs from weather, plants or animals that indicate a particular time of the year?

- Are there signs from weather, plants or animals that indicate the transition from one season to the next?
- Are there signs from weather, plants, or animals that are used to decide when to conduct certain seasonal activities?
- Are there cases where a sign from one plant or animal indicates an activity related to another plant or animal [e.g. appearance of a berry indicates the fish are running]?
- Are there indicators that used to be used to mark time, but are no longer used?
- Do you think that these indicators are changing? Which are changing? Are there some indicators that are changing more rapidly than others?

Traditional Calendars

- Seasons
    - What are the important attributes of each season?
    - How do you know when one season is transitioning into the next?
- Lunar calendar (moon cycles)
    - Would you know the names of any moon phases or cycles [e.g. harvest moon]?
    - What are the important attributes of each month [Gregorian or other]?
    - How do people in your community use the moon cycles?
    - Has the use of the lunar calendar changed over the course of your lifetime?
    - Do the names of moon cycles still fit with the seasons they describe [e.g. if the name of the month refers to hunting, is that when people harvest]?
- Other points of reference
    - When does your calendar begin?
    - What are other important days or events in your calendar?

Calendar of the Human Body

- Have you heard of the "Calendar of the Human Body"?
- Where have you heard of it? What is your knowledge of it?
- What is it? How was it used?
- Do people here still use it? If so, how is it currently used?
- What is its importance or significance to you?

Community life

- When are important community meetings and events?
- What are important holidays and commemorative days?
- What are the faster-paced times of year in your community?
- What are the slower-paced times of year in your community?
- Have community activities changed due to weather or other seasonal changes?
- Have community activities changed due to social or political events?

Weather

- What are the most important weather events in your community? When do they usually occur? Why are these events important?

- Does the weather vary from year to year? How so?
- What are the most unusual weather events that you have seen in your lifetime? What time of year did these events occur? How often do these kinds of events occur?
- Does weather differ from place to place around Sary Mogol? If so, how does it differ?

Plants

- Which are important plants for people in your community?
- Are these plants useful? What parts of the plant are useful? How are they useful?
- Are these plants abundant or rare? Are they becoming more or less abundant?
- Where are these plants found? In what kinds of places are they found? Are there specific sites where they are most abundant?
- [For domesticated plants]: When are these plants usually sown? How and when do you care for them? When do they usually produce leaves, flowers, and fruits? When are they harvested? How and when are they processed, stored, and distributed?
- [For non-domesticated plants]: When do they usually germinate and sprout? How and when do you care for them? When do they usually produce leaves, flowers, and seeds? When do they usually dry up, drop their leaves, or turn brown?
- How is plant behavior changing over time?

Animals

- What are the most important animals here? How are they important?
- What parts of the animal are useful? How are they used?
- Are these animals abundant or rare? Are they becoming more or less abundant?
- Where are these animals found? In what kinds of places are they found? Are there specific sites where they are most abundant?
- For domesticated animals: When do these animals reproduce? How and when do people take care of them? At what time of year are they sold or killed?
- For other animals: When do these animals give birth? When are the important times in their life cycle for you? Are these animals fished, trapped, or hunted? How and when are they prepared and stored?
- How is animal behavior changing over time?

5. **Additional sources of information** (5 minutes): Explain to the participant that you are conducting in person interviews with Elders and other knowledgeable community members from Sary Mogol. Based on their interview, ask if they would like to recommend anyone who would be able to provide additional information about the topics you have discussed.
6. **Closing** (5 minutes): Thank the participant for conducting the interview. Remind them to contact you or the project partners should they have any questions, suggestions, or concerns about the research.

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